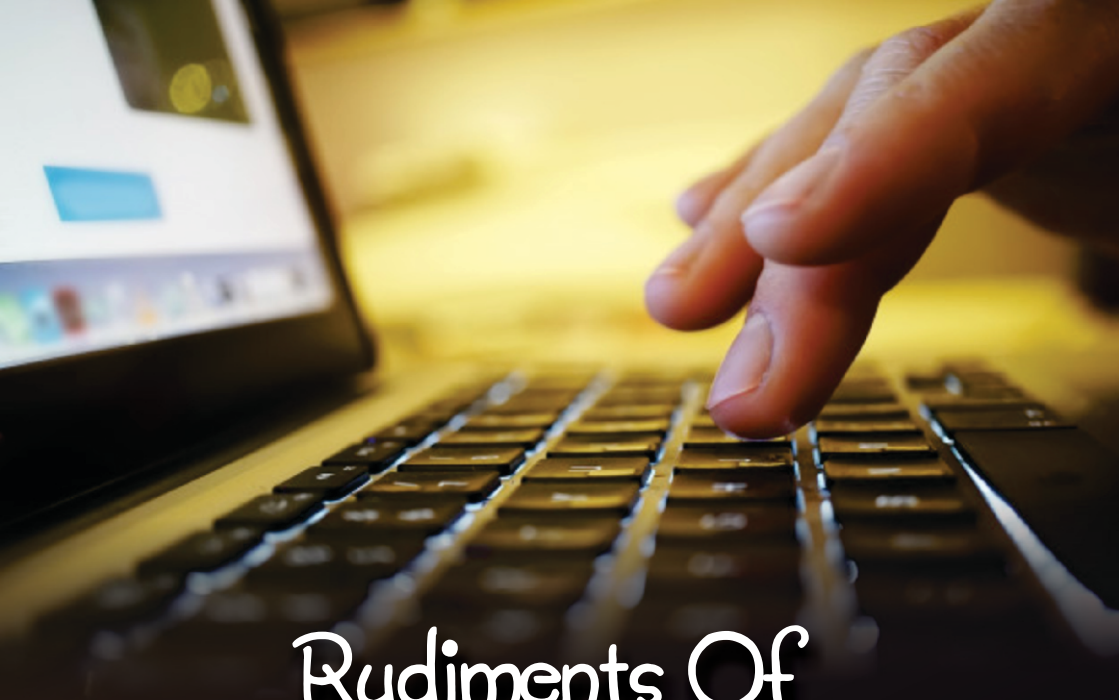

Rudiments Of INFORMATION TECHNOLOGY

(A CONTEMPORARY GUIDE FOR THE FOURTH INDUSTRIAL REVOLUTION)

FOREWORDED BY

PROF. PLO-LUMUMBA

LLD, D. Litt (hc) FCPS (K), FKIM, FAAS (hon)

MUJAHID AL-IBENU

Autograph

Dear Reader,

It is with great delight I welcome you into the new world of Information Technology. Please accept my greatest honor for acquiring this book. There are many of its kinds out there, but you choose to spend your valuable time on mine, so that you may see what I have to say. This is very important to me, and I regard your humility and support. This is my little contribution and suggestions in this prestigious field of learning, and what I have done here is to approach the subject from the beginners to the advanced level in addition to new techniques. I don't know it all, and I'm receptive to receiving any opinions, suggestions, corrections, and fair counter on subsequent pages.

One of the greatest attributes of Information Technology is that you never reach the end. Just about the time you master a particular topic or techniques someone develops a new gateway or procedure of operations. That is not to say that your original skillset is obsolete. On the contrary, a solid foundation for learning the beginners and advanced topics and staying current with the rapid pace of changes assigns you in for greater understanding of the subject matter.

I look forward to your reviews, opinion, suggestions, and corrections. Enjoy your study!

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Rudiments of Information Technology
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DEDICATION

This book is dedicated to God Almighty, and my humble mother, Mrs. Grace Al-Ibenu, and to all those who seek to improve the development of human beings in all spheres of life.

FOREWORD

The 21st century has been described as the information age. It is the era of the Fourth Industrial Revolution. The distinguishing feature of this age is the digital revolution with the computing at its heart.

It is the promise of the Industrial Revolution that it will change lives for the better but because fortune favours the vigilant, the promised changes will only accrue to those who are prepared and dare to embrace them.

In this book, appropriately christened "Guide," MM Al-Ibenu has made commendable effort to demystify the computer and computing.
In a simple yet effective style, the author has peeled the various layers of the computer and computing in a manner that is accessible and comprehensible even to those who are averse to technology.

Read in the contest of Africa Agenda 2063 and the Africa Continental free Trade Area (AfCTA), the "Guide" offers an avenue for young Africans to understand and appreciate how computing is now a ***conditio sine qua non*** to accessing the dividends of the Fourth Industrial Revolution.

The nexus between computing and socio-economic and political development may not be obvious but it cannot be gainsaid that technology is the elixir of sustainable development, hence the value of this "Guide."

This truly friendly "Guide" leaves both the layperson and expert appropriately informed and prepared to partake of the promises of computing in a world where illiteracy now means the inability to appreciate the significance of the computer and its ubiquitous and multiple uses.

I commend this "Guide!"

PROF. PLO-LUMUMBA, LLD, D. Litt (hc) FCPS (K), FKIM, FAAS (hon)

INTRODUCTION

The world today is witnessing a new kind of revolution -the *Information Revolution* - steered in by technology is far more sweeping than any other revolution in history in its reach and influence, bringing fundamental changes in all aspects of our life.

Information technology (IT) is the engine used to drive useful information systems. This includes computers, software, networks, and internet/intranet and telecommunication systems. IT provides the means for collecting, storing, encoding, processing, and anlysing, transmitting, receiving, and printing text, audio,or video information. In the present context, IT is not merely a matter of machines and microchips. Now it regulates all aspects of our lives including how we live.

This book as the name implies "*Rudiment of Information Technology"* is written to help you learn the processes, tools, techniques, and areas of knowledge needed to successfullly manage information technology (IT) projects.

Today, project management has emerged as its field, supported by a body of knowledge and research. Although still relatively new, the fields of management information systems (MIS) and software engineering have their bodies of knowledge that include various tools, techniques, and methods supported by a continually growing base of research.

Unfortunately, the track record for IT projects has not been as successful as one might expect, although the situation appears to be improving. One reason for this improvement has been a greater focus on a project management approach to support the activities required to develop and deliver a product, service, or information system. Just as building a system is more than sitting down in front of a computer and writing code, project management is more than just creating fancy charts or diagrams using one of the more popular project management software packages.

However, this book is an extensive effort and a contribution to the realization and promotion of the human right to education and information considering IT areas. I will hope that the rudiments given in this book will help you master basic computer knowledge and skills that will help you become a positive contributor to the world of IT, and with that hope, I wish you to learn as much as you can consequently becoming an active member of the Digital Age.

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CHAPTER ONE

INTRODUCTION TO COMPUTER SYSTEM

1.0. Aims and Objectives
1.1 Introduction
1.2 Characteristics of Computers
1.3 History of Computers
1.4 Computer System
1.5 Importance of Computer in Business
1.6 Chapter Summation
1.7 Discussions
1.8 Chapter Progress

1.0. AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. The characteristics of computers that makes them an essential part of every technology.
2. Computer system, which includes components such as central processing unit & I/O devices.

1.1 INTRODUCTION

The term computer is derived from the Latin word compute, which means to calculate. A computer is an electronic machine, invented for performing calculations and controlling operations that can be expressed either in logical or numerical terms. In simple terms, a computer is an electronic device that performs diverse operations with the help of instructions to process the information in order to achieve the desired results. Computer application extends to cover huge area including education, industries, government, medicine, scientific research et cetera.

A computer is one of the most influential forces available in modern times. Due to its memory, high speed and perfection, its application can be

extended to almost infinite levels. Millions of complex calculations can be done in mere fraction of time. Difficult decisions can be made with accuracy for comparatively little cost. Computers are widely seen as instruments for future progress and as tools to achieve substantiality by way of improved access to information by means of video conferencing and e-mail. Indeed computers have left such an impression on modern civilization that we call this era as the information age.

1.2 CHARACTERISTICS OF COMPUTERS

The main characteristics of computers are:

a) Speed
b) Storage
c) Accuracy
d) Versatility
e) Automation
f) Diligence
g) Reliability

a) **Speed:** Computers are capable of carrying out the task with enormous speed. Today's computers, according to their class, can perform from 4 MIPS (Millions of instructions per second) to 100 MIPS. What may take days for manual calculations may take only a few hours for computers to perform. Inside the computer the information signal travels at incredible electronic speed.

b) **Storage:** Computers can store enormous quantity of information. Which is expressed in terms of Kilobytes (or) Mega Bytes (MB) or Giga Bytes (GB). It is achieved through its 'Main memory' or 'Primary storage' and through 'auxiliary storage' or 'Secondary storage'. The Hard disks Floppy disk, Compact Disc (CD) and Magnetic Tape storage are examples of secondary storages. These large volumes of storage occupy much lesser space compared to paper documents and this aspect of computers makes them more powerful.

c) **Accuracy:** The accuracy of a Computer is consistently high. In fact, this quality of the computers make them indispensable in

various fields such as Scientific Research, Space Research, Weather Predictions and many other areas where precision of a high order is required. The accuracy of the computer is best achieved by programming them in the most efficient manner. When it comes to very complex mathematical or scientific problem the computer's accuracy has no substitute.

d) **Versatility:** Computers are versatile that they can perform almost any task, provided they are given the appropriate logical steps. For example, they are capable of performing wide ranging tasks such as construction of a payroll, inventory management in a factory, hotel billing, hospital management, banking applications and any imaginable task in every works of life.

e) **Automation:** The biggest advantage of computers is that it is automatic in its operation. Once a programming logic is initiated the computer performs repeated operations without human interventions until program completion.

f) **Diligence:** Computers are machines that do not get tired or 'lose concentration' like human beings. If a large number of calculations say million calculations are to be performed the resultant output will remain exactly the same even if operations are repeated any number of times. But when a human being is asked to do the same job this consistency cannot be achieved.

Hence for those who want consistent and continuous standard output, computer's 'diligence' is of great help.

g) **Reliability:** The computers give very accurate results with predetermined values. They correct and modify the parameters automatically, giving suitable signals. They give formatted results with high degree of precisions.

1.3 HISTORY OF COMPUTERS

In the early days of mankind, man used to count the head of cattle by putting lines on trees. Slowly these lines changed to numbers. To do

calculation on numbers he started inventing machines.

1. Abacus

Abacus was probably the earliest of counting devices. It consists of rectangular wooden frame with two compartments and beads sliding along the steel wires for counting. Multiplication and divisions are done using repeated additions and subtractions. Even today in which cross strings are fixed. Beads are inserted on to the strings. There are a number of rows of beads.

2. Napier's logs and bones

John Napier, a Scottish mathematician invented logarithms. The use of logarithms enabled him to transform multiplications and division problems of addition and subtractions. In the beginning he called logarithms as artificial numbers. But later he named them logarithms.

Napier also invented a computing device consisting of sticks with numbers carved on them. These sticks are called bones as they were made of bones. These bones helped a lot in multiplication involving large numbers.

3. Slide rule

As the name indicates, the slide rule has one scale sliding within the other. Suppose you want to add two numbers 3 and 5, set 3 on the fixed scale and slide the moving scale. So that its “0' coincides with”5” of sliding scale. This is the sum of 3 and 5. The process of reading could be quick if you are trained in the use of slide rule.

4. Calculating machines and Pascal's calculator

A French mathematician, Blaise Pascal invented a machine based on gear wheels. He was the son of a tax collector who had to do lot of calculations as part of his job. Blaise Pascal wanted to make his job easier by inventing a calculator. You might be familiar with gear wheels you use in your bicycle which meshes with a driving chain. He used similar gear wheels with ten teeth for each digit position. He fixed them together so that one wheel drives the other. When the wheel corresponding to units position rotated by ten teeth, it drove the wheel corresponding to the next higher position by one tooth. Thus one could make calculations. Pascal provided dials, which

indicated numbers stored on each wheel. He also used suitable "dialing system" to operate the gear wheels. Other people also made a number of such calculators.

Computer scientists honored Pascal by naming a programming language Pascal after him.

5. Babbage difference and analytical engines

Babbage, a British National and the son of a wealthy banker wanted to correct the errors in the logarithm tables being used during his time. In 1822, he made a machine which calculated the successive difference of expressions (X2 + ax + b is an example of an expression) and prepared table which helped him in his calculations. The royal Astronomical society awarded a gold medal to him for his invention and granted a large sum of money to carry out further work. He wanted to make an accurate calculating machine called "Babbage's Analytical Engine". The analytical engine was supposed to be very accurate. So it needed lot of parts made with precision. Babbage could not make such parts. He conceived that his machine would use input devices, would have a processing part called "mill" where you can perform calculations, would also incorporate.

It consists of rectangular frame in which cross strings are fixed. Beads are inserted on to the strings. There are a number of rows of beads. Since he was about 100 years ahead in his ideas, he could not get parts needed for his machine. This is because there were no tools to make such precision parts. He did lot of work related to making precision parts and spend all the grants (and lot of his money too) but failed in his attempt to make a machine. He ultimately died as a frustrated man.

6. Lady Ada Lovelace

Lovelace is the daughter of the famous English poet Lord Byron. She was a mathematician. She studied the works of Babbage and wrote about them. From her account only, we can see the close resemblance of the modern day computers and Babbage's work. Lady Ada Lovelace's contributions are very important. Since she predicted that computers can be programmed, a language, Ada used widely in America's Department of Defense Computers was named after her.

7. Herman Hollerith's Machine

Governments all over the world collect details about the number of people living in their countries. This information helps the Government in planning for the future, Sometimes you find enumerators (people taking such details) coming to your house with forms to collect such details. This operation is called "census" which is normally done once in 10 years.

In the United States a census was carried out in 1880 and the U S Government was processing the census data. Even as this was going on, the next census was due in 1890. To process the census of 1890 fast, the Government announced a competition.

Dr. Herman Hollerith Produced cards out of special paper pulp designed punching machines to punch holes in the card to count census figures and invented sorting machines to read such punched card and collect data. He could complete the job within three years, achieving a speedup of about three times.

8. ABC Computer

In 1937, Dr. John Atanasoff with the help of his assistant Berry designed the Atanasoff Berry Computer (ABC). The machine laid the foundation for the development of electronic digital computer.

9. ENIAC- Electronic Numerical Integrator and Calculator

In 1947 John Mauchly and Eckart completed the first large scale Electronic Digital Computer, ENIAC. In this computer, each time a program was changed, the wiring had to be completely rearranged. It weighed 30 tons, contained 18,000 vacuum tubes and occupied a space of 30 50 feet.

10. EDSAC-Electronic Delay Storage Automatic Calculator

Maurice V.Wilkes of Cambridge University completed EDSAC in 1949. EDSAC was the first computer to operate on the stored program concept.

11. UNIVAC-I – Universal Automatic Computers

In 1947, after ENIAC became operational Mauchly and Eckart formed their own Company- "The Eckart-Mauchly Computer Corporation." Immediately after this they started the design of UNIVAC-I. This was

purchased by US bureau of Census. UNIVAC was the first computer dedicated to business applications.

1.4 COMPUTER SYSTEM

A computer system is a combination of various components. It performs the system functions such as input, processing, output, storage and control. A computer system consists of the following components:

1. Hardware
2. Software
3. Human ware
4. Firmware
5. Bridge ware

1. Hardware

The physical components of the computer, such as electrical, electronic and mechanical unit are known as the hardware of the computer. That is, the input units, output units and CPU are called hardware. Thus hardware is the equipment involved in the function of a computer. It consists of the components that can be physically handled. The function of these components is typically divided into three main categories: input, output, and storage. Components in these categories connect to microprocessors, output and storage. Components in these categories connect to microprocessors, specifically, the computer's central processing unit (CPU), the electronic circuitry that provides the computational ability and control of the computer, via wires or circuitry called a bus.

2. Software

The computer performs operations like addition, subtraction, multiplication and division only when the user instructs it to do so. The user issues instructions and the CPU acts in accordance with the instructions. The sets of instructions, which control the sequence of operations, are known as *programs*, and collectively programs are called **software.** The software can be broadly classified into two types. They are:

a. System Software
b. Application software

3. Human ware

The man-machine interface is called a human ware. The people who work with the computer are collectively called the human ware or livewire.

4. Firmware

The computer programs permanently stored in ROM or PROM are called firmware. These programs are provided by hardware manufacturer along with the computers. Generally these are booting programs which help in the starting of a computer. Such programs cannot be erased or overwritten.

5. Bridge ware

The computer components and programs used to translate instructions and information written for one type of computer into a format that another type of computer can understand is called bridge ware. This is necessary because different computers are made by different manufacturers.

1.5 IMPORTANCE OF COMPUTER IN BUSINESS

Computer plays an important role in business environment as every organization adopts it in some form or the other to perform the tasks in effective manner. In the past few years' rapid development in IT, particularly in communications, electronic service networks, and multimedia have opened up new opportunities for corporates organizations. All these are contributing towards new and effective ways of processing business transactions, integrating business processes, transferring payments and delivering services electronically. It has affected the business in the following ways:

1. **Office Automation:** Computers have helped automation of many industrial and business systems. They are used extensively in manufacturing and processing industries, power distribution systems, airline reservation systems, transportation systems, banking systems, and so on. Computer aided design (CAP) and computer-aided manufacture (CAM) are becoming popular among the large industrial establishment.

2. **Stores large amount of data and information:** Business and commercial organizations need to store and maintain voluminous

records and use them for various purposes such as inventory control, sales analysis, payroll accounting, resources scheduling and generation of management reports. Computers can store and maintain files and can sort, merge or update as and when necessary.

3. **Improves Productivity:** With the introduction of word processing software, Computers have recently been applied to the automation of office tasks and procedures. This is aimed at improving the productivity of both clerical & managerial staff.

4. **Sharing of data and information:** Due to networking of computers, where a number of computers are connected together to share the data and information, use of e-mail and internet has changed the ways of business operations.

5. **Competitiveness:** Computers offer a reliable and cost-effective means of doing business electronically. Routine tasks can be automated. The customers can be provided support round the clock, which is 24 hours a day. With advancement in IT sector, corporates are spreading business around the world thus, increasing their presence and entering new markets.

6. **Security:** To provide security to data and important computer programs, almost every organization has some security programs to avoid the illegal access of the company's information by unauthorized persons. The three fundamental attributor of a security program are confidentially, integrity and availability which allow access to only authorized persons in an organization.

7. **Cost Benefits:** The extensive availability of internet based information means that companies have a wider choice of suppliers which leads to a more competitive pricing. Due to the presence of internet the role of the middleman becomes less important as companies can sell their product or services directly to the customer.

8. **Marketing:** Corporates engaged in e-business can take help of

their respective websites to create brand awareness of their products, thus, creating new avenues of promotion of their products. In addition, companies' websites can also provide better services such as after sales service to the customer.

1.6 CHAPTER SUMMATION

1. Computer is an electronic device that performs diverse operations with the help of instructions to process the information in order to achieve desired results. Speed, accuracy, reliability, versatility, diligence et cetera.
2. Many devices which humans developed for their computing requirements preceded computers. Some of those devices are Abacus, Napier's bones, Slide rule, Analytical engine and Hollerith's Machine.
3. Computer system consists of the various components which perform the system functions such as input, processing, output, storage and control.
4. Role of computers in business environment is essential for processing business transactions, Office Automation, Improving productivity, Competitiveness and security.

1.7 DISCUSSIONS

1. List all types of secondary storage devices.
2. What is the difference between memory and storage? Why do we require both to function properly?
3. Explain the characteristics of computers.
4. Explain in detail the history of computers.
5. Write notes on applications of computers in business.

1.8 CHAPTER PROGRESS

1. Your answer may include any of the following:

I). Speed
ii). Storage
iii). Accuracy
iv). Versatility
v). Automation

vi). Diligence

2. Human ware

The man-machine interface is called a human ware. The people who work with the computer are collectively called the human ware or livewire.

3. Role of computers in business

i). Office Automation
ii). Stores large amount of date and information
iii). Improves Productivity
iv). Sharing of data and information
v). Competitiveness
vi). Security
vii). Cost Benefits

CHAPTER TWO

HARDWARE AND SOFTWARE

2.0 Aims and Objectives
2.1 Introduction
2.2 Components of Hardware
2.3 Software
2.4 Features of Software
2.5 Difference between Hardware & Software
2.6 Chapter Summation
2.7 Discussions
2.8 Chapter Progress

2.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. Meaning of hardware and software.
2. Components of hardware.
3. Features of software.
4. Difference between hardware and software.

2.1 INTRODUCTION

A computer system consists of **hardware**, the physical unit (parts) of the computer that are capable of computing and manipulating information and *software* (set of instructions or programs) that carries out predefined tasks to complete a given job. The computer performs operations like addition, subtraction, multiplication and division only when the user instructs it to do so. The user issues instructions and the CPU acts in accordance with the instructions. The sets of instructions, which control the sequence of operations, are known as *programs*, and collectively programs are called **software.**

We can equate hardware and software with human body and human

intelligence, respectively. All human physical actions such as walking and eating are based on the thoughts and feelings, which is raised by the brain. If the brain does not raise thoughts and feelings, we do not perform any physical activity. Similarly, the actions and functioning of every hardware equipment is driven by software. The combination of physical equipment (hardware) and logical instructions (software) gives modern computing system their power and versatility.

2.2 COMPONENTS OF HARDWARE

I. Input unit: This unit accepts instructions and data.
II. Output unit: This unit communicates the results to the user.
III. Storage unit: This unit stores temporary and final results.
IV. Central Processing Unit (CPU): This unit performs processing of instructions and data inside the computer.

The CPU has three components:

a) The Control Unit
b) The Arithmetic Logic Unit (ALU) and
c) The Memory Unit.

a) Control Unit

It controls the overall operation of the computer system. It is considered as the heart of the computer system. It controls all the other units, directs them to operate in a proper way and co-ordinates various operations performed.

It instructs the input device to transfer the data and instructions to the main memory and then to the arithmetic and logic unit (ALU). Then, it sends the processed result from ALU to the memory unit for storage and transfers it to the visual display unit or to the printer.

The control unit coordinates the various parts of the computer system - the arithmetic logic unit, the memory unit and the peripheral units. Besides, it controls the flow of data into, from and within the main storage as per the program instructions.

To perform its control operations effectively and quickly, the control unit

has four basic components. They are;

(a) Instruction Register
(b) Decoder
(c) Address Register
(d) Instruction Counter

The instruction register receives one by one the instructions to be executed in the required sequence. Then, the operation code of the instructions is transferred to decoder, which decodes the operation code. And it activates the appropriate circuits of the arithmetic and logic unit to perform the operation. The address register enables the data in the location specified in the instruction to be transferred to a specified accumulator for the arithmetic and logic unit.

b) Arithmetic Logic Unit (ALU)

This unit performs two kinds of operations, the arithmetic processing and logical processing. In arithmetic processing it performs all mathematical operations such as addition, subtraction, multiplication and division. In logical processing, it performs the relational and logical operations such as comparing larger or smaller values, true or false statements, etc.

c) Memory Unit

This unit holds the intermediate results during the course of calculations and provides the data as at when required. This internal storage is also called primary memory or main memory. This memory takes the data from an input device and stores it until the computer is ready to process it. It also stores processed data and intermediate results. When the processing is finished, it transfers the results to an output device.

2.3 SOFTWARE

Software is a generic term for organized collection of computer data and instructions. It is responsible for controlling, integrating, and managing the hardware components of a computer and to accomplish specific tasks. In other words, software tells the computer what to do and how to do it. For example, software instructs the hardware what to display on the user's screen, what kinds of input to take from the user, and what kinds of output to generate. Thus, software communicates with the hardware by

organizing the control sequences, and the hardware carries out the instructions defined by the software.

A computer needs to be instructed to perform any task. These instructions are given in the form of *computer programs,* which are written in computer programming languages. A program controls the activity of the processor. The moment the hardware (processor, memory, etc.), acts as per the instructions of a program, the program is said to be in *running* or *executing* state.

A set of programs, which are specifically written to provide the user a precise functionality like solving a specific problem is termed as a *software package.* For example, word processing software package provides functionality to the computer so that it can be used to create text documents like letters and mailing lists. Similarly, an image processing software package assists a user in drawing and manipulating graphics.

2.4 FEATURES OF SOFTWARE

1. Ease of use

The software systems and applications are becoming more and more easy to use. In fact, software developers and system analysts go to great lengths to ensure that the products they develop are user-friendlier than their competitor's products.

2. Graphical user interface (GUI)

GUI or graphical user interface has now become the default standard for most of the software applications. Gone are the days of the crude character based interfaces of UNIX and DOS application. Today's software applications and products provide the users with perceptive, graphical and easy-to-use interfaces. Now the users do not have to remember the cryptic system commands or shortcut keys that were a must in the character based era. Now almost any task can be accomplished by a mouse click.

3. Multi-platform capability

Today's software applications are not developed for just one platform. Most of the software applications supports multiple platforms-both hardware and software platforms. There are software applications that

support hardware platforms ranging from mainframes to PCs and different software platforms like MVS, Solaris, AIX, UNIX, Windows and so on. For example IBM's DB2 Universal database is available for a variety or hardware and software platforms.

Another important feature of today's software application is that they support multiple languages and multiple currencies. Many vendors are providing their applications in many languages like English, Arabic, Japanese, and Chinese and so on.

4. Compatibility with other software

Now the competition for each market segment in the software marketplace is rather fierce. We have many software vendors battling for the market share in the same segment. For example, Microsoft Word 2000 supports all previous versions of work like Word 97, Word 6, and so on. The two features –compatibility with earlier versions and compatibility with other products make it easier for the users, as they can choose the application they want and still use the old files they have created using other applications or using older versions of the same application.

5. Mail enabling

Mail enabled applications are designed to take advantage of an e-mail. These are the familiar word processors, spreadsheets, and other individual desktop applications that have email features built to them. There is another class of message-centered programs that are built specifically around e-mail functions.

6. Web enabling

With the ever-increasing popularity of internet and the amount of information that is available on the net, most software applications are now web-enabled. Web enabling helps the user in many different ways. Its use starts while the user is installing the application. During installation, most of the applications will automatically connect to the Internet and to the vendor's web site and will register their products (earlier one had to fill in a paper form and mail or fax it to the vendor).

2.5 DIFFERENCE BETWEEN HARDWARE & SOFTWARE

HARDWARE	SOFTWARE
1. It is the physical unit of the computer.	It is a collection of programs to bring the hardware system into operation.
2. It has permanent structure and cannot be altered.	It has no permanent structure but can be altered and reused.
3. It is normally affected by agent like dust, heat, humidity, etc.	It is not affected by these agents to some extent.
4. Hardware understands only machine Language, lower level language or Binary level language which is readable by human being.	It is written by a well versed programmer.
5. It works with binary code, the presence Or absence of Pulses as 1's or 0's.	It is represented by the Higher Level Languages such as BASIC, COBOL, Etc.

2.6 CHAPTER SUMMATION

1. Hard ware is the physical component of the computer, and software is the instruction given to the components to perform certain operations.
2. Software consists of certain features like ease of use, Graphical user interface (GUI). Multiplatform capability, Compatibility with other software, Mail enabling, Web enabling
3. Certain differences existing between hard ware and software have been discussed.

2.7 DISCUSSIONS

1. What are the functions performed by CPU?
2. Discuss in detail about the features of software?
3. List out the differences between hardware & software.

2.8 CHAPTER PROGRESS

A. Spread sheet and Database - Software
Mouse and Scanner - Hardware

B. Hard ware is the physical unit (parts) of the computers that are capable of computing and manipulating information.

CHAPTER THREE

DATA PROCESSING

3.0 Aims and Objectives
3.1 Introduction
3.2 Data Processing Cycle
3.3 Data Types
3.4 Kinds of Data Processing
3.5 Objectives of Data Processing
3.6 Steps in Data Processing
3.7 Practical Data Processing Applications In Business
3.8 Data Processing Operations
3.9 Chapter Summation
3.10 Discussions

3.0. AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. Concepts of data processing and data processing cycle
2. Objectives and steps in data processing.
3. Various types and kinds of data processing.
4. Applications of data processing in business.

3.1 INTRODUCTION

Data Processing Concepts

❖ **Data**

Data means any collection of raw hand figures facts. Data can be considered as the raw material of information. The data may be numerical such as payroll, employee number, etc. Or non-numerical like Student names, Product names, etc.

❖ **Data Processing**

As data is in its raw form it cannot solve any problem. The data needs some

processing to make it useful. Data processing is the conversion of data into a more useful form. That is, transmission of data into meaningful information is called data processing.

❖ **Information**

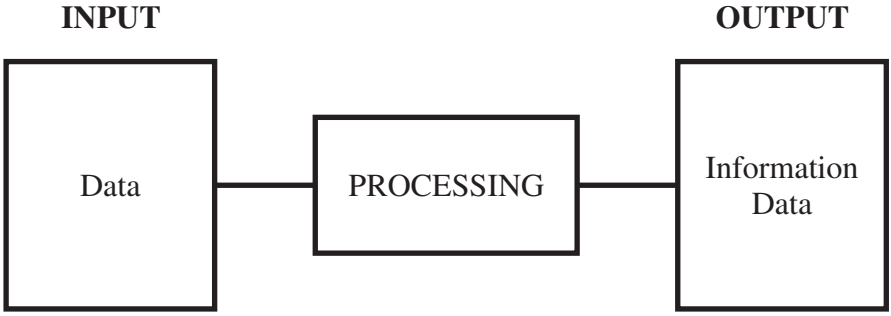
The result obtained by data processing is called information. That is, the processed data is known as information. However, information produced in one data processing step may be used as data in the next data processing step.

DATA VS INFORMATION

DATA	INFORMATION
Raw Records	Completed ones
Unordered	Ordered
Unrefined Data	Refined Data
What Prevails	What Necessary

3.2 DATA PROCESSING CYCLE

Data Processing is viewed as a system that accepts data as input, processes it into information as output. This can be explained with the help of the following diagram.



3.3 DATA TYPES

The data types may be as follows:

1. **Qualitative data**: It denotes the characteristics of things such as Average, Fair etc.
2. **Quantitative data**: It is expressed in terms of measurable

quantities such as 10 KG, 40 degree Celsius etc.

3. **Numeric Types**: The data types may also be an integer (+, -) without any fractional part or real number which includes integers and fractions.
4. **Floating Point Representation**: These data types consist of 3 components namely:
   (1) Mantissa (2) Radix or Base and (3) Exponent
   Besides the above, the data types include alphabetic data and alphanumeric data.

3.4 KINDS OF DATA PROCESSING

The important kinds of data processing are as follows:

1. **Manual Data Processing**: Data is processed without the help of mechanical devices. Here the data is processed using manual things such as abacus, slide rule, Napier bones etc.
2. **Mechanical Data Processing**: In Mechanical Data Processing, mechanical devices like calculators, tabulators, etc., are used for processing.
3. **Electronic Data Processing**: In Electronic Data Processing, the data is processed by either analog or digital computer.

3.5 OBJECTIVES OF DATA PROCESSING

After the industrial revolution, the needs of mankind increased. Man had to deal with large volume of data. He had to muddle through with more and more information. The information collected is to be sorted out, stored and retrieved at short intervals. This necessitated the concept of data processing.

As the complexities of business increased, the number of functions to be performed also increased. The data processing system must be responsible to supply the information when it is needed, so as to make the performance of the organization optimum.

Let us briefly have a look at the general objectives of Data Processing.

1. Handle huge volume of Data

The basic objective of data processing is to handle huge data in order to

enable the organization to function efficiently.

2. Qualitative and quantitative information

The next important want of data processing is to provide qualitative and quantitative information.

3. Proper and Timely Information

Different kinds of information are needed in almost all organizations. Data processing provides correct and timely information.

4. Storage and retrieval of data

Through data processing, information can be stored and retrieved as at when necessary.

5. Helps in Decision-making

In every organization various decisions are taken at different levels. Such decisions can be more accurate if effective data processing system is used.

6. Improves Productivity

To improve productivity, various measures are to be identified and implemented. It is possible through the properly designed data processing system.

7. Maintaining Performance at Optimum Level

To maintain the performance of the organization at best possible level various functions at different levels of the organization are to be coordinated. There should be a smooth flow of information among various functional departments. This can be easily achieved through data processing system.

8. Efficient Office Management

In office management, data processing plays a very important role through which office automation can be done.

3.6 STEPS IN DATA PROCESSING

1. Identifying the data
2. Input of Data.

3. Manipulation of Data.
4. Output of Information.
5. Storage of Information

1. Identifying the data

Accuracy of information depends on accurate data input. The first step in data processing therefore, is to locate necessary facts and figures from source documents. Accurate, relevant and adequate data must be used as input.

2. Input of data

After extracting the necessary data from the source documents, they must be reordered in a suitable form acceptable to the computer. Great care should be taken to avoid wrong entries in the forms.

3. Manipulation of data

It involves the process of shifting, sorting and rearranging the given input. Before processing, validation procedures may be built in to the code so that input forms do not accept any incorrect data.

4. Output of information

The main purpose of data processing is to provide meaningful information to the decision-maker. Hence, in data processing the person involved must be very careful about what information is needed and in what form he likes to have it.

5. Storage of information

The data processed need to be kept for future use. All the processed data will need some form of secondary storage. When storing the data, it is always important to maintain a backup. It should be noted that at each and every step the storage might be done.

3.7 PRACTICAL DATA PROCESSING APPLICATIONS IN BUSINESS

The following are some data processing information undertaken by commercial organizations.

1. Process Control

In the production process, a computer is directly connected to some plant to control and monitor it. Here, the computer receives the data directly from the plant. It analyses the input data and initiates action to control the on-going process.

2. Accounting

The Data Processing System can be used to maintain the accounting records and in preparation of final accounts. The general ledger, Accounts Payable, Accounts Receivable, etc., are the examples for the computerized accounting systems followed in most business organizations.

3. Payroll preparation

In personnel department the data processing system is used to record the operations of the number of employees of different departments in each shifts, leave taken, salary upfront, deductions such as ESI, PF and finally in the preparation of Pay Slips.

4. Sales Analysis

The Data Processing system is highly useful in sales analysis. The sales manager can prepare the sales forecast on the basis of per month's sales reports and subsequent future actions can be taken.

5. Inventory Management

Essentially the Data Processing System is an advantage to every organization, in respect of inventory management. Data Processing is used to maintain up-to-date information about stock, their costs and to initiate orders when the times are about to be exhausted.

6. Office Automation

The modem offices and business organizations are dependent upon computer based office automation for their competitiveness and better management.

7. Banking and Insurance

Data Processing Systems are highly needed in the Banking sector where the customer satisfaction is the main criteria. To provide quick and perfect

service, data processing system is used. Automatic Teller machines are places in big cities and linked to central computers. Hence, the delay in processing is completely avoided.

8. Insurance and stock broking

Insurance companies and stock broking firms also use the computerized data processing systems. Large volume of data have to be processed for the preparation of policy statements, interest calculations, renewal notices and in dealing with the securities.

9. Managerial aid

The Data Processing System is used as a managerial aid in decision-making for solving business problems. It is also very useful in the areas of linear programming, PERT, CPM etc.

Today it appears that the computer is everywhere. Not only the business organization, the other institutions are also using data processing system for their regular use. We cannot think about a situation without a computer. Robotics and Artificial Intelligence are the two promising areas of applications.

3.8 DATA PROCESSING OPERATIONS

The data after some processing is transformed into information, which is organized and meaningful. It includes the following operations.

1. Data Generation

It involves the operation of collecting the original data. It implies that the raw data are collected and set out in the form of original document called a source document.

2. Recording

Here raw data is converted into an acceptable form. That is, the data is transcribed from the source documents on the cards or on some other specified forms and are made readable for the machines. This operation is performed throughout the IPO cycle. The punched cards and paper tapes, magnetic tapes, magnetic disks, tape cassettes, floppy disks, magnetic drums, RAM cartridge, charged coupled devices, etc., are used as data

recording media.

3. Verification
After the data have been recorded, their accuracy has to be checked. This can be done with the help of another machine called verifier or by re-reading.

4. Classification
Classification of information is the next important operation in which the data is separated into various categories.

5. Sorting
Sorting involves sequencing the data in a pre-determined order to facilitate processing.
The order may be either alphabetic or numeric.

6. Merging
It is the operation of combining two or more ordered (sorted) sets of data to form another single ordered set.

7. Calculating
Here calculation of greater magnitude can be processed. Calculation involves solving equations and manipulation of the source data such as addition, subtraction, etc.

8. Data Storage
The results of processing one set of data are retained in storage for future use of reference. The basic requirement for utilizing the computer in all business applications is the ability to store and access data. The data is stored in a location called memory referred by its address. In large organizations, huge volume of data is to be stored and accessed. Hence, some auxiliary storage devices are also needed for the effective data processing.

The memory is measured by the following units:
(a) BIT (Binary digit)
It is the smallest possible unit of information. It can be either 0 or 1.

(b) NIBBLE

Four bits form one nibble

(c) BYTE

It is a unit of information consisting of fixed number of bits. It is a combination of 8 bits.

(d) CHARACTER

It is represented by one byte. It can be a letter, digit, punctuation mark or special characters.

(e) WORD

The combination of 2 bytes or 4 bytes or 8 bytes is a word.

The data measurement is as follows:

8 bits	- 1 byte
1024 bytes	- 1 kilobyte (KB)
1024 KB	- 1 Mega Byte (MB)
1024 MB	- 1 Giga Byte (GB)
1024 GB	- 1 Tetra Byte (TB)

(f) SECONDARY STORAGE (Backing/Auxiliary Storage):

(a) Magnetic disk - it includes the following:
Hard disk – Rigid, Floppy disk - Flexible
(b) Magnetic tape
(c) Magnetic drum
(d) Mass storage Device - cartridge
(e) Optical Disks - CD ROM (Compact Disk - ROM)

9. Data Retrieving

Data retrieving is the process of searching or locating a data item from the storage. In EDP system, the data is retrieved from the storage device in sequential, indexed sequential or random access mode. The on-line data storage and retrieval is very useful for the proper functioning of a modern business establishment.

10. Reporting

Generally in business data processing, the processing operation comes to an end with the reporting of data. In this operation the results of the data processing are made available to others. The processed information may be reported in a number of ways depending on the use of results.
The results may be printed out in the form of pay slips, bills, etc. or in the form of reports as ESI Reports, PF Reports or Sales Reports, etc.,

3.9 CHAPTER SUMMATION

1. Data in its raw form cannot be used. It must be converted into information to make it useful.
2. To process the data various steps are involved such as identification of data, input and manipulation of data etc.
3. Data processing is useful for decision making and improving productivity in an organization.

3.10 DISCUSSIONS

1) Write short notes on the objective of data processing.
2) What are the steps involved in Data Processing? Explain.
3) Explain in detail about Data Processing Operations.

3.11 CHAPTER PROGRESS

1. Steps in data processing
i. Identifying the data
ii. Input of data
iii. Manipulation of data iv. Output of information
iv. Storage of information

2.
i. Process Control
ii. Accounting
iii. Payroll preparation
iv. Sales Analysis
v. Inventory Management Office Automation
Banking and Insurance vii. Insurance and stock broking Managerial aid

CHAPTER FOUR

COMPUTER APPLICATIONS

4.0 Aims and Objectives
4.1 Introduction
4.2 Business Applications
4.3 On-Line Applications
4.4 Real-Time Applications
4.5 Chapter Summation
4.6 Discussions
4.7 Chapter Progress

4.0 AIMS AND OBJECTIVES

After reading this Lesson you will be able to understand:

1. Various computer applications in business.
2. Application of computers for real time processing and online processing

4.1 INTRODUCTION

Computer plays a very important role in each and every aspect of our life, be it banking, insurance or transportation, it is useful for preparing payroll of the employees, maintenance of optimum inventory level, sales order processing, reservation of tickets etc. It processes the transactions very quickly and accurately. So, it finds applications in various stages of business.

4.2 BUSINESS APPLICATIONS

The following are some of the areas of business in which computers are applied:

1. Payroll Processing

Business means selling goods and services. To carry out such activities,

business management employs people. They have to be paid monthly salaries and the details regarding pay particulars of employees have to be kept track.

Business community employs computers for such payroll applications and runs a program consisting of a number of smaller programs or modules. Each module performs a particular function of the payroll. Sometimes we call this set of programs as payroll system.

To calculate the pay of an employee, management normally uses the following details of employees.

(1) Employee number (This is a unique number assigned to the employee to identify him just as your roll number in the school) (2) Name, (3) Basic pay, (4) Allowances (House rent allowance and other allowances), (5) deductions (Example Provident Fund deduction) and (6) Bank account number. These details above the employees do not change but they have to be used every month. So they are entered into a file in a computer storage medium and permanently stored. This file goes with the name master file. The file creation module of the payroll system creates this file once.

Before calculation of the pay of employees every month, some figures in the master need changes. For example, if an employee completes a year of service, he normally gets an increment. Such figures are updated using the master update module of the payroll system. After updating, another module of the payroll system reads details from master file and calculates net pay. The program also prints out pay slip for each employee to be handed over to him. A pay slip shows the employee number, name, basic pay, various allowances, various deductions and net pay.

The payroll system also generates a number of statements. It prints out the statement showing employee number, name, bank account number and net pay. This statement is sent to the bank, which transfers the net pay from the company's account to the individual employee's account in the bank. Some companies copy this statement on to a floppy and send to the bank which processes this statement on its computer.

The payroll system generates a provident fund deduction statement. This statement shows the employee numbers, names and amount deducted. Another statement showing the names, employee numbers and tax deducted is printed. The company sends it to Income Tax office. Thus we see that a number of statements can be printed from the same master file.

2. Inventory Control

The second application is the use of computers to keep track of the purchase and issues of parts and raw materials needed in an organization. These parts and raw materials are called inventories and the set of programs used to keep track of the purchase and issue of these inventories constitute the inventory control system.

In business, a particularly quantity of each item or raw material has to be stocked. Too less a stock would result in non-availability of these items, when the manufacturing activity needs it. Too much of stock of this means, more money in terms of investment in buying the excess stock. Business pays interest on money invested, and the excess interest paid on cost of excess stock is a loss to business. So the business maintains an optimum quantity of material. The inventory control system maintains a file with part number, name, quantity on stock a level of stock at which the company orders for fresh quantity (called reorder level) and the suppliers' addresses. This file is the inventory master.

When an item is issued, the inventory update program updates the inventory master reducing the stock by the quantity issued. If the resultant stock falls below the reorder level, the inventory control program prints out an order to the supplier of the item automatically. It can be mailed to the supplier. When the supplier supplies the item, the inventory control program updates the stock on hand.

The inventory control system keeps track of the supplies and issues. So, it can tell the management of the company the usage of these items over a period of time quickly. It also maintains an optimum level of stock of these items.

3. Sales Order Processing

Real –time systems offer the possibility of a greatly prompt service to the customer. His order can be processed within virtually no time. The finished goods inventory file may have data terminals throughout the sales territory. So much that the CRT's can be made to display the invoice on a terminal for the salesman who is in the customer's plant and can input the particulars there and then! The customer would be made immediately in the general ledge. The invoice can also be posted to the accounts receivable file instantaneously. The selection of warehouse that is closest to the customer can also be made and a copy of the invoice could be displayed at the warehouse terminals. Besides, the following functions can be performed rapidly.

- ❖ The inquiries about the customer's accounts status can be answered by the salesman.
- ❖ Credit appraisal can be carried out on-line.
- ❖ Sales analysis master file can be updated online. This file provides a ready information to the sales manager regarding sales trends, etc., Inventory replenishment order is determined as a part of the sales order processing.

4.3 ON-LINE APPLICATIONS

1. Banking

In banks the customers, present cheques for withdrawing money. The clerk verifies from the register the signature of the customer. (The customer has signed in the application form while opening an account). Then he checks from a ledger the customer's balance. If the customer has sufficient balance to cover the cheques amount, the clerk passes the cheques for payment, and updates the balance.

There are a number of operations that the bank carries out of which the above is an example. We will see how the above operation called personal banking is computerized.

Suppose you want to open a bank account. The bank official hands over a form to you. You fill up the details (such as name, address, profession etc.) and sign the application. The bank stores this information in a computer

on which banking software runs. The customer's signature is scanned by suitable devices and incorporated in the computer file.

If you present a cheque to the clerk in the bank, he can check the signature manually. If he is satisfied with the correctness, he can enter your account number and the cheque amount into the computer which checks your account and updates the amount. The clerk then pays you the money. In the method, the payment is manual and accounting is automatic. There is another way where the checking of your accounts as well as payment is made by computer using an automatic teller machine. Let us briefly study this.

A machine similar to automatic coffee vending machine is installed at selected places. It is connected to the bank's computer. When you open an account, the bank gives you a special type of card. Your name, account number and address are suitably recorded. Your signature is magnetically recorded in that card. All these details are suitably converted and recorded in the computer also. When you want to withdraw money, you go to the teller counter and press a few buttons. You then insert your card in the slot provided in the machine. The machine reads your account number and signature from the card. It sends them to the computer which checks your account number and signature. If they tally, the computer sends a relevant message to the automatic teller machine. It asks you to enter the amount. You may enter the amount through the buttons on the machine. Again the computer checks if you have sufficient balance. If so, it instructs the machine to pay you. The ATM then delivers the cash on the tray fixed in it. You may collect the money.

This is only one example of application of computer in banks. Now large systems installed at the head office of a particular bank are connected to systems installed at its branches all over the country. The computers of different banks are also connected together. By sending suitable messages money can be transferred from one bank to the other. This is called Electronics Funds Transfer.

2. Railway Reservation System

Application of computers in railway reservation has made tremendous

impact in India. Before computerizing, there were a number of counters, each counter serving a particular train or a few trains. If you want to make a reservation to Delhi for instance, you have to go to the particular counter and join the queue. The clerk had a register in which two or three pages are allotted to each date. He may have two or three more registers for other trains for which he is making reservation.

He puts seat numbers on a page one by one and keeps writing the names of passengers for whom he reserves seats against seat numbers. After some time, if somebody cancels his ticket, he strikes off the name. When the next person reserves for that time and date, the clerk writes his name above the cancelled name. This gives rise to lot of confusions. In a number of situations, two persons used to be allotted the same seat.
With the increasing population the Government is increasing the number of trains. Thus the volume of data to be handled has also increased enormously. You can just imagine the confusion this will create if we are still following the manual system of reservation.

We just saw how manual system has become unsuitable in the present context. Now let us study how the computerized railway reservation system works.

There is a central computer with a number of terminals connected to it the details of all trains for which reservation is done at the region are stored in the computer. The railway reservation system runs on this computer. The terminals are situated in booking counters. It is possible to install the terminals in a far off place and connect them to the computer through cables.

When the passenger presents the reservation form to the booking clerk he enters the train number, date, name, age and other details of the passenger. The program checks availability of seats in that particular train on that particular date. If accommodation is available, the clerk presses a button on the keyboard and the computer prints out the ticket on the printer connected to the terminal. It also updates the computer file to reflect the new reservation position.

Suppose you wanted the ticket for train number 1, but you get only a waiting list. The clerk tells you your position in the waiting list. If you want you can get a wait listed ticket. If not, you tell the clerk to check for accommodation in a different train to your destination. The clerk only has to re-enter the train number. The computer checks availability, reserves your ticket on that train if a seat is available and prints the ticket.

Thus you can go to any booking counter and request for reservation in any train being operated on that station. Also the errors found in the manual reservation method are eliminated.

The reservation system is broader based as follows: Today computers in different cities are connected together. (It is called networking). Suppose you are in Lagos City of Nigeria. You want to book your journey from Benue to Lagos. You can go to a booking counter (Railways have opened a number of booking counters in the same city) in Lagos and reserve your ticket from Benue to Lagos. Thus there is lot of flexibility in reservation.

We studied that computers are capable of storing lot of data on the hard disk. They are also capable of retrieving data fast. So the list of passengers for a particular day for a particular train is also printed out very fast.

The reservation data for a number of trains over a period of time is available. By suitable software, the railway authorities can prepare the data regarding passengers traveling in different trains to different places during different periods. This helps them plan for new trains, reschedule the running trains and make lot of analysis regarding passenger traffic.

3. Air Lines Reservation System

We saw how computers handle the railway reservation and offer a number of advantages. They can be used also in Airlines reservation. Only difference will be that some booking counters in the reservation network may be situated in different countries.

This means that we have to connect computers across the countries. Such networks are operational in this modern age which is an electronic age.

In the coming years, computerized reservation systems will become very common. Even hotel accommodation reservation systems for major hotels are coming up. If we integrate flight and hotel reservation, it is convenient for the passengers.

4.4 REAL-TIME APPLICATIONS

In real time applications, computers control an ongoing activity. Let us consider the example of a manufacturing process. A product C is made from raw materials A and B. The quality of C depends upon, among other things, the quality of A and B and their quantities. In big manufacturing processes, raw materials are fed by machineries. Due to problems in machineries, the performances may vary from machine to machine. This affects the quality of final product. Manual inspection of quality and operation of these machineries to control the quantity are slow. This slows the manufacture of C from raw materials A and B. Signals from C are fed to the computer. Suitable sensors are installed in the lines carrying raw materials as well as finished product. These generate signals. The values of these signals for correct proportion of raw materials are stored in the computer. When the process is on signals keep coming from the output line depending upon the quality of finished product.

Let us see what happens if either A or B varies in quality. The quality of the finished product also suffers. The sensor in the finished product line senses this. The signals generated by it change in strength. They are sent to the computer. It compares the signals with already stored signals. The difference is used to change the quantity of raw materials A and B.

Manual control of this process is slow. Moreover, if people inspect quality and operate machineries feeding raw materials, they become tired after sometime. But computer does not. So the quality of product is uniform. Moreover, there may be processes where the presence of human beings continuously for hours together will be injurious to their health. In such places computer control avoids such ill-effects.

4.5 CHAPTER SUMMATION

1. Computer is useful in business processes like payroll processing for generating statements useful for various departments like

provident office, ESI etc.

2. It is useful for inventory control activities such as maintaining optimum inventory level and re-order level.
3. Online applications in banking and reservation have brought about advantages like saving of time and money.
4. Car manufacturing industries and other production functions use real time applications effectively.

4.6 DISCUSSIONS

1. Explain in detail about the application of computers in business.
2. Explain in detail about on-line applications.
3. Write short notes on Real-Time Applications.

4.7 CHAPTER PROGRESS

A. Sales order processing
B. Inventory control
C. Payroll processing

CHAPTER FIVE

COMPUTER RELATED JOBS

5.0 Aims and Objectives
5.1 Introduction
5.2 Computer-Related Jobs
5.3 Chapter Summation
5.4 Discussions
5.5 Chapter Progress

5.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. Various job opportunities available in the computer field.
2. Nature of job of a programmer, system analysts, web designer
3. Information technology enabled services like BPO.

5.1 INTRODUCTION

The fast spread of IT has generated a need for highly trained workers to design and develop new information systems and to integrate new technologies in them. It is creating the need for professional workers who can fulfill the high performance standards in the technology based industries. The IT professional plan, design, develops, support, and manage the strategies and adopt them to fulfill basic objectives of their firm. The rapidly changing technology requires the employees to have more skills and education. The companies look out for IT professionals who not only have sound technical knowledge of the subject but also have sound interpersonal and communication skills.

5.2 COMPUTER-RELATED JOBS

1. Programmer

A programmer is a person who writes the code for a computer program. Computer programs are the instructions given to the computer, telling the

computer what to do, which information to identify, access and process. The programmers write programs, depending on the specifications given by the systems' analysts and software engineers. After the completion of the design process, the programmer's job is to convert that design into a series of instructions that the computer can follow. These instructions are coded in a programming language such as C, C++, and Java, and then tested to ensure that the instructions are correct and produce the required result. Programmers perform functions such as system designing, and its related services. They are involved in coding of a project and the successful implementation of the developed system.

There are two types of programmers – application programmers and system Programmers. The application programmers code programs for a specific task (application) in the organization. On the other hand, the systems programmers code programs for controlling and maintaining the computer system software.

2. System Analyst

A systems analyst plans, designs, develops, and implements new systems or applies the existing system resources to perform additional operations. Most of the systems analysts work with specific type of system like business, accounting, finance, science or engineering and so on. Some systems analysts are also known as system developers or system architects.

A system analyst determines the problem in the system by discussing it with the managers and users before starting an assignment. They study the information needs of the organization to determine the changes that are required to deliver a solution to the problems of users. To design a system, the systems analysts specify the inputs required by the system, plan the processing steps and finalize the output to meet the user's requirements. Next, the systems analyst determines the hardware and software needed to set up the system.

Systems analysts prepare the specifications, flowcharts, and process diagrams for the computer programmers to follow, and then work with the programmers to debut, and to rectify and errors in the system. They also

check the initial use of the system and organize tests to check the working of the system to ensure that it works as required of planned. Systems analysts who perform more intricate testing of products are referred to as software quality assurance analysts. They not only perform tests but also diagnose the problems, suggest solutions and checks whether the program requirements have been met or not. The analysts, who design, test and evaluate the Internet, Intranet, local area network (LAN), wide area network (WAN) and other data communications system are called network and data communications analysts.

3. Network Administrator

A network administrator is a person who installs, configures, and supports the local area network, wide area network, the Internet system or the segment of a network system in an organization. Every network in an organization requires at least one network administrator. Network administrators perform the functions such as installation, configuration, maintenance of computers, and networking of equipment. They also check and ensure the availability of network to all the users. They supervise the support of other networks and plan, coordinate and implement network security measures.

4. Database Administrator

A database administrator (DBA) is an individual who is responsible for the storage of data, management of the database, and implementation of the database management system. They work with database management systems software and determine ways to organize and store data. They identify user requirements, set up the computer databases, and test and organize the modifications to the systems. They also ensure the performance of the system in the organization, understand the platform on which the database is running and adds new users to the system. DBA is responsible for maintaining data integrity, backup systems and database security.

5. Web Designers

A web designer is an individual who provides an architectural structure for the effective communication of clients' content by logically organizing the information and making it accessible. With the rapid growth of the

Internet, many jobs relating to design, development, and maintenance of the web sites and servers have cropped up in the market. The web designer controls all aspects of design and programming of elements of text and visual design. They are responsible for maintaining all technical aspects of a web site, including its performance issues such as speed of access and approving the content of the web site. Web designers create the artistic feel of the web site, facilitate navigation, and make content on the web site accessible to the users.

6. Information Security Analyst

An information security analyst is an individual who performs highly complex analysis and technical tasks involving assignment and co-ordination of measures to provide information assurance, event detection, and rapid response across various environments of the enterprise. Information security analysts design, implement and support integration of information security solutions including security architectures, firewall administration, integrating security products, and developing and coordinating security implementation plans. They provide technical support on security projects that involve a wide range of issues including secure electronic data traffic, network security, platform and data security and privacy. They review and contribute to the security activities of business application and development project plans across all business units.

8. Information Technology Specialist

An **information technology** (IT) **specialist** is a computer support and security administrator who assists companies and organizations with managing hardware, software, networking and solving problems. These professionals go by a range of titles, including **information** security analyst and network administrator. **Duties of an information technology specialist** can include network management, software development and database administration. IT **specialists** may also provide **technical** support to a business or an organization's employees and train non-**technical** workers on the business's **information** systems.

7. Business Process Outsourcing

Business Processing Outsourcing (BPO) refers to a decision to assign to

another party some or all non-core processes. The main motive of BPO is to allow the company to invest more time, money, and human resources into core activities and building strategies, which helps in company growth. The BPO jobs include various sectors like finance, accounts, customer support, IT services, medicines, among other. Today, the global market is highly competitive and ever changing. A company must focus on improving productivity and even cut down costs. Therefore, many tasks that use precious time, resources and energy, are being outsourced. BPOs, or the units to which work is being outsourced are flexible, quicker, and cheaper and very efficient in performance of the work.

5.3 CHAPTER SUMMATION

The vast spread of IT has generated versatile jobs such as programmer, Systems Analysts, Network Administrator, Web Designer, Information Security Analyst, IT Specialist and many more.

5.4 DISCUSSIONS

Explain in detail about various computer related jobs in business.

5.5 CHAPTER PROGRESS

1. Programmer

A programmer is a person who writes the code for a computer program. There are two types of programmers-application programmers and system programmer.

2. System Analyst

Systems analysts analyses how well software, hardware and the wider IT system fit the business needs of their employer or of a client.

3. Network Administrator

Network Administrators install and maintain hardware and software, document diagnosis and resolution of faults, manage user passwords, security and inventory documentation.

4. Database Administrator

The **responsibility** of a **database administrator** (**DBA**) will be the performance, integrity and security of a database. He is involved in the

planning and development of the database, as well as in troubleshooting any issues on behalf of the users.

5. Web Designers

The **web designer** has the ability to understand what is needed to make a **website** functional and easy to use, but at the same time make it aesthetically appealing to the user.

6. Information Security Analyst

Information Security Analysts assess system vulnerabilities for **security** risks and implement risk mitigation strategies. Ensure appropriate **security** controls are in place that will safeguard digital files and vital electronic infrastructure, respond to computer **security** breaches and viruses.

7. Information Technology Specialist

Duties of an **information technology** specialist can include network management, software development and database administration.

8. **Business Process Outsourcing**

Contracting of non-primary **business** activities and functions to a third-party provider. **BPO** services include payroll, human resources (HR), accounting and customer/call center relations. **BPO** is also known as information technology enabled services (ITES).

CHAPTER SIX

TYPES OF COMPUTER SYSTEMS

6.0 Aims and Objectives
6.1 Introduction
6.2 Various Types of Computer Systems
6.3 Basic Principles of Operation of Digital Computer
6.4 Chapter Summation
6.5 Discussions
6.6 Chapter Progress

6.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. The types of computer systems which are classified into Analog, digital, micro, mini, mainframe & super computers et cetera.
2. Differences between analog and digital computers.
3. Basic principles of operation of a digital computer.

6.1 INTRODUCTION

Our society is being reshaped by rapid advances in information technologies, Computer, Telecommunication networks and other digital systems that have vastly increased our capacity to know, achieve and collaborate. These technologies allow people to transmit information quickly and widely, linking distance places and to create communities that just a decade ago were unimaginable.

It is difficult to appreciate just how quickly information technology is evolving. Five decades ago ENIAC, one of the earliest computers stood ten feet tall and stretched eighty feet wide; while today, one can buy a musical greeting card with a silicon chip that is 100 times faster than ENIAC. This extraordinary phase of information technology is bringing people and cultures together and creating new social dynamics in the

process. It is leading to the formation of closely bonded and widely dispersed community of people united by their interest in doing business or in sharing experiences and intellectual pursuits. New forms of knowledge accumulation are developing, as computer based learning system that opened the way to innovate modes of instruction and learning.

SIMPLE TIPS OF COMPUTER

A computer is an electronic machine, operating under the control instructions stored inside its memory. As an aid in problem solving, it accepts data, both numeric and non-numeric, processes and presents it in the desired form.

The following are the various types of computer systems:

6.2 VARIOUS TYPES OF COMPUTER SYSTEMS

1. Analog Computers

Analog is the Greek word, which means similar. So, in analog computers, the similarities between any two quantities are measure by electrical voltages or current. The analog computers operate by measuring instead of counting.

The analog computer works on the supply of continuous electrical signals. The display is also continuous. Its output is in the form of graphs.

Analog Signal: An analog signal is a continuous variable electromagnetic wave. It can consume an infinite number of voltage or current values.

Characteristics of analog computer

The analog computer has the following important characteristics:

a) It operates by measuring.
b) It requires physical analog.
c) It functions on continuously varying quantities.
d) The output is usually represented in the form of graph.
e) In analog, the calculations are first converted in equation and later converted into electrical signals.
f) The accuracy of the output is poor.
g) It has limited memory space.

h) It is not versatile. i.e., it has limited application.
i) The speed of analog computer is low.
j) Not suitable for business and industry.

2. Digital Computers

These computers work with quantities represented as digits. They operate on discrete quantities. In digital computer, both numeric and non-numeric information are represented as strings of digits. These computers use binary codes, 0's and 1's, to represent the information. The information is given to the computer in the form of discrete electrical signals.

The basic operation performed by a digital computer is addition. Hence, the other operations such as multiplication, division, subtraction and exponentiation are first converted into "addition" and then computed.

Characteristics of digital computer

The digital computer has the following characteristics:

a) It operates by counting.
b) It functions on discrete numbers.
c) The calculations are converted into binary numbers i.e., 1s and 0s.
d) The output is represented in the form of discrete values.
e) Its accuracy is good.
f) It has large memory space.
g) It is versatile in nature and is suitable for a number of applications.
h) In digital computers, the numbers, words and symbols can be used.
i) It's processing speed is high.
j) It is highly suitable for business application.

ANALOG VS DIGITAL COMPUTER

	Analog computer	**Digital computer**
1.	It operates by measuring	It operates by counting
2.	It requires physical analog	It functions on discrete numbers
3.	The calculations are first converted to equations and later converted into electrical signals	The calculations are converted into binary numbers (1s and 0s)
4.	The output is in the form of graph	The output is in the form of discrete values

5. Less accurate	More accurate
6. Less speed	High speed
7. Limited memory is available	More memory is available
8. Lacks flexibility	Highly flexible
9. Cannot process alpha-numeric Information	Can process alpha number Information
10. Limited application	More number of applications
11. Not suitable for business Applications	Highly suitable for business Applications

3. Hybrid computers

The computer which possess the features of both analog and digital computers are called hybrid computers. That is, the hybrid computers have the good qualities of both analog and digital computer.

With the hybrid computer the user can process both continuous and discrete data. This computer accepts either digital or analog or both types of input and gives the results as per requirements through special devices. In the hybrid computers a converter is fixed to convert the analog data into digital data and vice versa. These are special purpose devices and are not widely used.

4. General Purpose Computer

These are designed and constructed to cater almost all the needs of the society. They can perform various operations. In fields of engineering, science, commerce and industry. They are able to perform according to the programs created to meet different needs. The general – purpose computer can be used to prepare stores reports, sales reports, payroll, etc. a general purpose computer can solve a much broader class problems specifically a general purpose digital computer is remarkably versatile.

5. Special Purpose Computers

These computers are designed to solve a particular problem or task, the computers are provided with limited memory and speed necessary for a particular job. The instructions needed to perform the particular task are incorporated into the internal memory of the computer. It does not possess unnecessary options, hence it is economical. E.g. Business purpose

computers and scientific purpose computers.

6. Micro Computers

Because of its small size and the use of micro-processor, this computer is called microcomputer. All the computers have three units namely input, output and central processing unit, (CPU). The entire CPU is contained in a single or a few microchips. When equipped with memory and input/output control circuitry, it is called microcomputer. Its storage capacity is low when compared to mini and main frame computers. It is able to accept most of the high level languages. However, it uses an interpreter or complier for running high level languages.

Microchips contain microelectronic circuitries which are very tiny. Large numbers of these can be packed tightly on to a single tiny piece of silicon. Silicon is a material found in sand. The microchip is made by building up a series of very thin layers of silicon and of the tiny components which are held in it.

The Micro computers are small and portable. They are relatively inexpensive; the micro computers have excellent graphic capabilities. The maximum word length varies according to the configuration of the microcomputers.

Kinds of Microchips

The microchips can be classified as follows:

a) **Micro Processors:** These are the most powerful kind. They are almost tiny computers in themselves. Each one has a processing Unit, a memory and a special area to handle input and output. Microprocessors are the most important part of the CPU of a modern computer

b) **Memory Chips:** These are the common form of computer memory. They are used to hold information either temporarily or permanently.

c) **Input and Output Chips:** In these chip circuits the flow of information is the both directions.

Features of Micro Computers

a) Its storage capacity is low.
b) Its rate of acceptance and transfer of data is limited i.e., a maximum of 5 kilobytes / second.
c) It is able to accept most high level languages. However it uses an interpreter when running high level language because most micros do not have sufficiently large memory to support compilers.
d) The maximum word length it holds is 16-bits.

Advantages

a) They are small and portable.
b) They are relatively inexpensive.
c) They work as soon as they are switched on.
d) They have excellent graphic capabilities,
e) They do not occupy much space.
f) They do not consume much power.

Disadvantages

a) Micros have a limited storage capacity.
b) They are relatively slow.

7. Workstation

Workstation is a type of computer used for engineering applications (CAD/ CAM), desk top publishing, software development, and other types of applications that required a moderate amount of computing power and relatively high quality graphics capabilities. Workstations generally come with a large, high-resolution graphics screen, at least 64MB (Megabytes) of RAM, built – in network support, and a graphical user interface. Most workstations also have a mass storage device such as a dish drive, but a special type of workstation, called a diskless workstation, comes without a disk drive. The most common operating systems for workstations are UNIX and Windows NT. In terms of computing power, workstations lie between personal computers and mini-computers, although the line is incoherent on both ends high-end personal computers are equivalent to low-end workstations. And high-end workstations are equivalent to minicomputers. Like personal computers, most workstations are single-user computers. However, workstations are typically liked together to

form a local-area network, although they can also be used as stand-alone systems.

8. Mini Computers

The size of the mini-computer is in between the size of micro and main frame computers. It is more powerful than a micro-computer. Mini computers are usually designed to serve multiple users. Today, mini-computers are the popular data processing systems in the field of business and industry. These computers accept all high level languages.

Characteristics

1. It is a general purpose machine with a smaller CPU than a main frame
2. Its storage capacity is about 2 mega words
3. Its word lengths are usually 12, 16, 24, 32 bits.
4. Its rate of acceptance and transfer of data is a maximum of 4 million bytes/seconds
5. It can support all high level languages.
6. It can support many terminals i.e., more than 20 terminals.

Advantages

a) It performs almost all the tasks that a mainframe computer does.
b) It is relatively inexpensive and is within the purchasing power of the small and medium sized business firms.

Disadvantages

a) They are very expensive.
b) They required large room space.
c) Their consumption of electricity is very high.
d) Maintenance coast is also very high.

9. Super Computers

The super computers are very costly. Hence it is rarely used. Its capacity is abnormally high, it cannot be compared with any other computers in capacity, function, speed, accuracy, language etc., they have operations done in parallel, rather than sequential. They are employed for specialized applications that require immense amounts of mathematical calculations.

The chief difference between a super computer and a main frame computer is that a super computer channels all its power into executing a few programs as fast as possible. But main frame uses its power to execute many programs concurrently. CRAY – 3, Cyber 205, and PARAM are some well-known super computers.

Characteristics

a) They use several processors working simultaneously.
b) They process at a rapid speed.
c) The main memory ranges from 8 to 64 megabytes.
d) They have operations done in parallel, rather than sequentially. They are used in weather forecasting, supersonic aircrafts design and other works that require billions of calculations per second.
e) They can be used for animated graphics-fluid dynamic calculations etc.,

10. Laptop computer

Laptop computer, simply laptop (notebook computer or notebook), is a small mobile computer, which usually weighs 2-18 pounds (1-6 kilograms), depending on size, materials, and other factors.

Laptops usually run on a single main battery or from an external AC/DC adapter which can charge the battery while also supplying power to the computer itself. Many computers also have a 3 volt cell to run the clock and other processes in the event of a power failure.

As personal computers, laptops are capable of the same tasks as a desktop computer, although they are typically less powerful for the same price. They contain components that are similar to their desktop counterparts and perform the same functions, but are miniaturized and optimized for mobile use and efficient power consumption. Laptops usually have liquid crystal displays and most of them use different memory modules for their random access memory (RAM), for instance, SO-DIMM in lieu of the larger DIMMs. In addition to a built-in keyboard, they may utilize a touchpad (also known as a track pad) or a pointing stick for input, though an external keyboard or mouse can usually be attached.

6.3 BASIC PRINCIPLES OF OPERATION OF DIGITAL COMPUTER

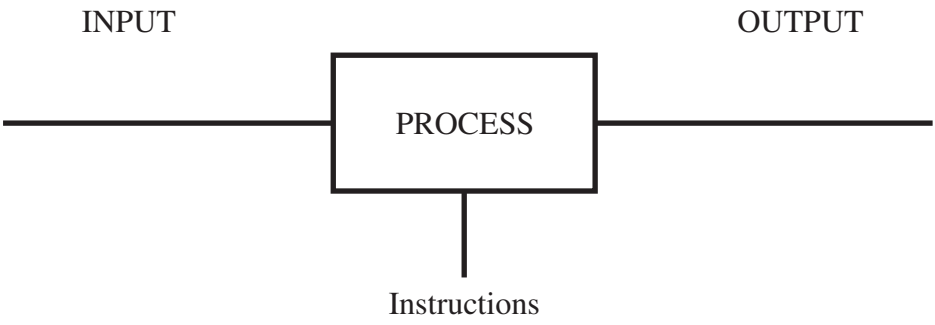
Today, the most commonly used computers in business are digital computers. Even though they may differ in constructional details, the basic principles of operation are almost the same.

A computer is basically a device used for processing of data; it performs the following three operations in sequence:

a) Receives the data and instruction.
b) Processes the data as per the instructions.
c) Output the result i.e., information.

This cycle of operation of a computer is known as the input process – Output cycle. This can be explained in the following figure.

IPO Cycle

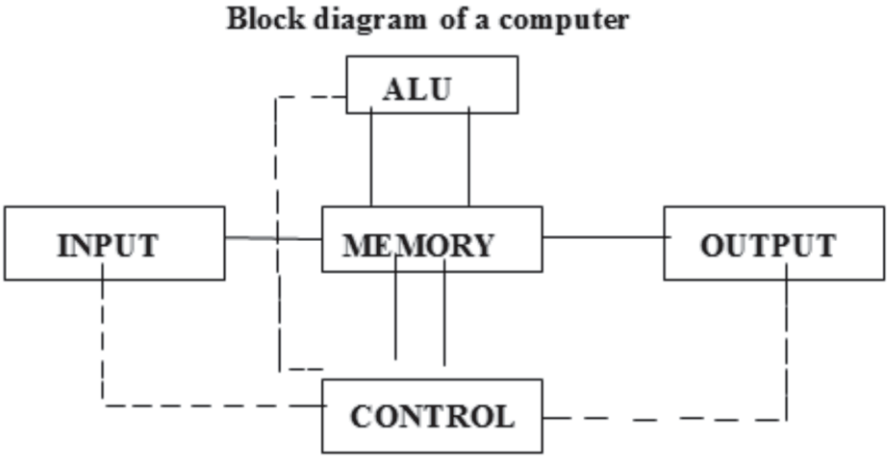


The data are provided to the computer through the input devices. They are encoding such a way, which the computer can understand. The computer then processes the data with the help of instructions provided to it, and then it produces a meaningful and desired output known as information.

The above functions are collectively known as the basic principles of operation of a digital computer. These can be expanded as follows:

a) Accepting inputs
b) Memory manipulation

c) Arithmetic operations
d) Decision making and
e) Giving output



6.4 CHAPTER SUMMATION

1. Analog computers- calculations are converted to equations and then converted into electrical signals. Output is in the form of graph.
2. Digital computers- calculations are converted into binary numbers and output is in the form of discrete numbers**.**
3. Hybrid computers include the characteristics of both analog and digital computers.
4. A microcomputer is a small, low cost digital computer, which usually consists of a microprocessor, a storage unit, an input and output channel, all of which maybe on one chip inserted into one or several PC boards. Microcomputers include desktop, laptop and handheld models such as PDAs
5. A minicomputer is a small digital computer, which is normally able to process and store less data than a mainframe but more than a micro-computer.
6. A mainframe is an ultra-high performance computer made for high volume, processor intensive computing. It is mainly used for large

volumes of data processing, high performance online transaction processing systems.

7. A super computer is a special purpose machine. There are unique and parallel architectures in order to achieve high speed and being effective on a small range of problems.

6.5 DISCUSSIONS

1) Explain in detail about various types of computers.
2) List out the characteristics of analog computers.
3) Write short notes on the characteristics & Digital Computers.
4) List out the differences between analog and Digital Computers.
5) Explain the basic principles of operation of Digital Computers.

6.6 CHAPTER PROGRESS

A microcomputer is a small, low cost digital computer, which usually consists of a microprocessor, a storage unit, an input and output channel, all of which maybe on one chip inserted into one or several PC boards. Microcomputers include desktop, laptop and handheld models such as PDAs

CHAPTER SEVEN

GENERATION OF COMPUTERS

7.0 Aims and Objectives
7.1 Introduction
7.2 Generations of Computers
7.3 Chapter Summation
7.4 Discussions
7.5 Chapter Progress

7.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. Various technologies used in different generations.
2. Characteristics of computers of each generation

7.1 INTRODUCTION

The history of computer development is often discussed with reference to different generations of computing devices. In computer terminology, the word generation is described as a stage of technological development or innovation. A major technological development that fundamentally changed the way computers operate resulting in increasingly smaller, cheaper, more powerful and more efficient and reliable devices characterize each generation of computers.

7.2 GENERATIONS OF COMPUTERS

1. First Generation (1940-1956): Vacuum Tubes

First generation computers were vacuum tube / thermionic valves-based machines. These computers used vacuum tubes for circuitry and magnetic drums for memory. A magnetic drum is a metal cylinder coated with magnetic iron-oxide material on which data and programs can be stored. Input was based on punched cards and paper tape, and output was displayed on printouts.

First generation computers relied on binary-coded language (language of 0s and 1s) to perform operations and were able to solve only one problem at a time. Each machine was fed with different binary codes and hence were difficult to program. This resulted in lack of versatility and speed. In addition, to run on different types of computers, instructions must be rewritten or recompiled.

Examples: ENIAC, EDVAC, and UNIVAC.

Characteristics of first generations computers

- ❖ These computers were based on vacuum tube technology.
- ❖ These were the fastest computing devices of their times. (computation time was in milliseconds)
- ❖ These computers were very large, and required a lot of space for installation.
- ❖ Since thousands of vacuum tubes were used, they generated a large amount of heat. Therefore, air conditioning was essential.
- ❖ These were non-portable and very slow equipment's. The lacked in versatility and speed. They were very expensive to operate and used a large amount of electricity.
- ❖ These machines were unreliable and prone to frequent hardware failures. Hence, constant maintenance was required.
- ❖ Since machine language was used, these computers were difficult to program and use.
- ❖ Each individual component had to be assembled manually. Hence, commercial appeal of these computers was poor.

2. Second Generation Computers (1956-1963): Transistors

In the sixties, there was lot of development in semiconductor field - a field of materials. In vacuum tubes, a filament is heated to emit electrons, (the basic component of an atom) that carry current. In 1946,Willam Shockley and a few of his colleagues invented **transistors**, which do not need any heating to liberate electrons in addition to being smaller in size, they saved power due to the absence of heating and hence the cooling needed. The smaller size resulted in smaller distances that the electrons have to travel to transmit information from one part of the computer to another. Hence calculations became faster. The reliability also increased. Today we cannot see any second generation computers.

The smaller size of components saw mass production of computers which became cheaper. Many companies started buying and using them increasing the demand. Computer programming languages developed further to make programming easier and user friendly. Yet if you compare today's computers, they were a lot behind. The increased use of computers and the consequent mass production sent the prices crashing down. Computer scientists and electronic engineers were developing more sophisticated computers.

Characteristics of second generation computers: These machines were based on transistor technology.

- ❖ These were smaller as compared to the first generation computers.
- ❖ The computational time of these computers was reduced to microseconds from milliseconds. These were more reliable and less prone to hardware failure. Hence, such computers required less frequent maintenance.
- ❖ These were more portable and generated less amount of heat.
- ❖ Assemble language was used to program computers. Hence, programming became more time efficient and less cumbersome.
- ❖ Second generation computers still required air conditioning.
- ❖ Manual assembly of individual components into a functioning unit was still required.

3. Third Generation Computers (1964 - early 1970s): Integrated circuits

In second generation computers, one could recognize the circuit components such as transistors, resistors and capacitors distinctly. There were physically separate or "discreet". Slowly scientists started integrating these components together so that they are not separate. They were fused into the circuits. People called it large scale integrated circuits (LSI). Computers using such components were called third generation computers. Since components were packed together more densely, the size of computers became smaller. Programmers also developed more sophisticated software. By 1970, engineers developed a device called microprocessor. Lot of circuits was packed into it. Intel 4004 was one such chip.

Characteristics of third generation's computers

- These computers were based on integrated circuit (IC) technology. They were able to reduce computational time from microseconds to nanoseconds. They were easily portable and more reliable than the second generation.
- These devices consumed less power and generated less heat. In some cases, air conditioning was still required.
- The size of these computers was smaller as compared to previous computers. Since hardware rarely failed, the maintenance cost was quite low.
- Extensive use of high-level languages became possible.
- Manual assembling of individual components was not required, so it reduced the large requirement of labor and cost. However, highly sophisticated technologies were required for the manufacture of IC chips. Commercial production became easier and cheaper.

4. Fourth Generation Computers (Early 1970s – till date): Micro processors

More and more circuits were packed in a microprocessor. The components were integrated further and very large scale integration (VLSI) technology revolutionized computer field further. Intel Corporation made chips such as 8080 and 8086 to be followed by 80286, 80386, 80486 and now the Pentium processor. These chips perform calculations faster. They are not only used in computers, but also in measuring devices and even in house hold devices such as washing machines.

Computers using such VLSI chips progressively shrunk in size. Computers using the microprocessors are termed as microcomputers. The software technology also developed further. Programmers developed more sophisticated and user friendly software. In course of time, the cost of these computers have come down so much that even individuals bought them so they came to be known as personal computers.

Characteristics of Fourth generation computers

- Fourth generation computers are microprocessor-based systems. These computers are very small.

- ❖ Fourth generation computers are the cheapest among all the other generations. They are portable and quite reliable.
- ❖ These machines generate negligible amount of heat, hence they do not require air conditioning.
- ❖ Hardware failure is negligible so minimum maintenance is required. The production cost is very low. GUI and pointing devices enable users to learn to use the computer quickly. Interconnection of computers leads to better communication and resource sharing.

5. Fifth Generation Computers (Present and beyond): Artificial Intelligence

Up to fourth generation, the classification was based purely on hardware. Fifth generation computers are classified based on software also. VLSI technology is used in fifth generation computers. They have large main memories. The speed is also high. In addition to all this, Fifth generation computers run software called 'expert systems.'

Characteristics of Fifth Generation computers:

❖ **Mega Chips**

Fifth generation computers will use super large Scale integrated (SLSI) chips, which will result in the production of microprocessor having millions of electronic components on a single chip. In order to store instructions and information, fifth generation computers require a great amount of storage capacity. Mega chips may enable the computer to approximate the memory capacity of the human mind.

❖ **Parallel Processing**

Most computers today access and execute only one instruction at a time. This is called serial processing. However, a computer using parallel processing accesses several instructions at once and works on them at the same time through use of multiple central processing units.

❖ **Artificial Intelligence (AI)**

It refers to a series of related technologies that tries to simulate and reproduce human behavior, including thinking, speaking and reasoning. AI comprises a group of related technologies: expert systems (ES), natural

language processing (NLP), speech recognition, vision recognition, and robotics.

7.3 CHAPTER SUMMATION

1. Based on the type of processor installed in the computer, the generations of computers are classified into five.
2. In First generation, Vacuum tubes were used. So the computer was very large in size. It used binary coded language to write programs.
3. In second generation, transistors were used. So the computer became small in size. Computer programming languages were developed and programming also became easier.
4. In third generation, Integrated circuits were used. Sophisticated software was also developed. This helped to reduce computational time.
5. In fourth generation, microprocessors were used. Sophisticated and user friendly software was also developed. This helped to reduce computational time further and cost of computers also came down considerably.
6. VLSI technology is used in fifth generation computers. They have large main memories. The speed is also high. In addition to all this, Fifth generation computers run software called 'expert systems.'

7.4 DISCUSSIONS

1. Discuss in detail about the various generations of computers.
2. List out the characteristics of First Generation Computers.
3. Write short notes on the characteristics of 2nd Generation Computers.
4. What are the characteristics of 4th Generation Computers?

7.5 CHAPTER PROGRESS

Vacuum tubes	-	First Generation
Transistors	-	Second Generation
Integrated circuits	-	Third Generation
Micro processors	-	Fourth Generation
Artificial Intelligence	-	Fifth Generation

CHAPTER EIGHT

DATA PROCESSING SYSTEMS

8.0. Aims and Objectives
8.1 Introduction
8.2 Data Processing Systems
8.3 Chapter Summation
8.4 Discussions
8.5 Chapter Progress

8.0. AIMS AND OBJECTIVES

At the end of this lesson, you will be able to understand:
1. Various methods of data processing.
2. Draw backs and special features of data processing

8.1 INTRODUCTION

The methods of data processing depend upon the following factors:
(a) Volume of data to be processed
(b) Complexity of data processing operations
© Computational demands
(d) Processing time constraints and
(e) Economic factors.

Various methods or modes of data processing are given below:
(i) The single user system
(ii) Batch processing
(iii) Multi-programming
(iv) On-line Processing
(v) Real-Time processing
(vi) Time sharing concept
(vii) Distributed processing

8.2 DATA PROCESSING SYSTEMS

The methods of data processing are explained below:

1. The single user system

It is one-man show and is indicative of one of the earlier stages of computer development. Here only one person can work at a time. Hence, especially if the machine is meant for the use of many persons, much computer time is wasted waiting for one person to finish and debug his program on the machine.

2. Batch Processing

This is an old system but even today it is used for data processing in computing machines, in which the capacity of the CPU is limited. In this system, the data is collected for a predetermined period of time, after which it is accumulated in sequential manner.

In this system the source transaction documents are first collected before being sent to computer room. A batch of transactions is entered onto a computer media by data entry devices. The transactions are validated during data entry and verified with the source documents from the check lists. The validated and verified results on reports are returned to the user departments. In batch processing system the emphases is on maximizing the computer resource utilization.

In batch processing, the processing cycle called Batch processing cycle repeats itself at every regular interval. The elements in the cycle are given below:

(i) Data capture.
(ii) Data transmission.
(iii) Data transcription, verification and validation.
(iv) Job Processing.
(v) Job assembly putting together the batch for processing. (vi) Job disassembly (separating out the reports after processing) (vii) Reports and distribution.

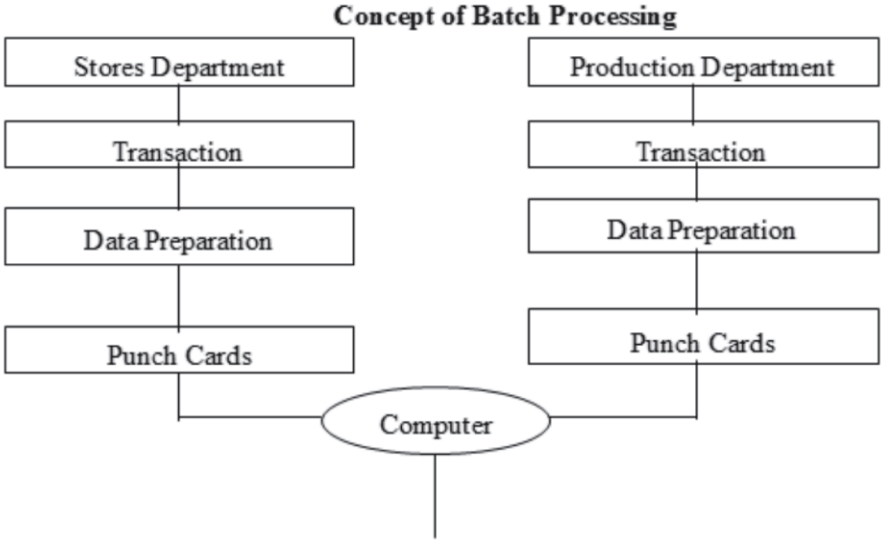
Features

(a) Here, the data is accumulated into batches and processed

periodically.

(b) The jobs are processed one after the other without any user interaction.

The concept of Batch Processing is dearly explained with the help of the following diagram:



Examples of applications which can use batch processing are:

(1) Payroll Processing: In payroll processing the data are collected for a stipulated period of time usually one month and processed at regular intervals after which payments are distributed to all the employees.

(2) Telephone Billing: Here the subscriber does not get a bill for every call he makes. Instead, his calls are recorded at a centralized place and are processed on a predetermined period of time to prepare his bills.

(3) Financial accessing

(4) Budgeting and Budgeting control

(5) Production planning and control

(6) Project planning and control

Drawbacks in Batch Processing:

The following are the drawbacks of batch processing:

1. Time gap between capture of data
2. Time consuming to debug
3. Delay in generating reports

3. Multi-programming

In batch processing, programs are executed one by one. The memory and ALU of the machine are not being fully utilized. To get the maximum use of the machine, multiprogramming system is used. “Multi-programming enables to store and execute more than one program in the CPU at the same time”. The multi-programming concept is event based. The purpose of multi-programming is to increase utilization of the computer system as whole.

Multi-programming is defined as execution of two or more program that all reside in primary storage. Since the CPU can execute only one instruction at a time, it cannot simultaneously execute instructions from two or more program. However, it can execute instructions from one program then from second program then from first again, and so on. This type of processing is referred to as concurrent execution. Using concept of concurrent execution, multi-programming operate in the following way:

When processing is interrupted on our program, perhaps to attend an input or output transfer, the processor switches to another program. This enables all, parts of the system, the processor, input and output peripherals to be operated concurrently thereby utilizing the whole system more fully. When operating on one program at a time the processor or peripherals would be idle for a large proportion, if the total processing time, even though this would be reduced to some extent by buffering. Buffering enables the processor to execute another instruction while input or output is taking place rather than being idle while transfer was completed. Even then, when one program is being executed at a time, basic input and output peripherals such as floppy disk drive and line printers are slow compared with the electronic speed of the processor and this causes an imbalance in the system as a whole. However, in a multi-programming environment the CPU can execute one program's instructions while a second program is

waiting for I/O operations to take place.

In a system of multi-programming storage is allocated for each program. The areas of primary storage allocated for individual programs are called 'partitions'. Each partitions must have some form of storage protection and priority protection to ensure that a program must have some form of storage protection to ensure that a program is one portion will not accidentally write over and destroy the instructions of another partition and priority (when two or more programs are residing in primary storage) because both programs will need access to the CPU's facilities (e.g.; the arithmetic and logic section) A system of priority a method that will determine which program will have first call on the computer's facilities is normally determined by locating the program in a specific partitions.

Programs that have the highest priority normally are stored in an area called the 'foreground partition.' Programs with lowest priority are stored in an area called 'background partition'.

4. On-Line Processing

Definition of Online Processing

Online processing refers to processing of individual transactions as they occur from their point of origin as opposed to accumulating them into batches. This is made possible by such direct access devices as Magnetic disk and Magnetic Drum and number of terminals connected to, and controlled by a central processor. In this way, various departments in a company can be connected to the process by cables. If operating companies are a number of miles away from the processor then they are linked by means of telegraph or telephone lines. This type of processing provides multi access to information files by terminal users and also enables them to update with transactions data.

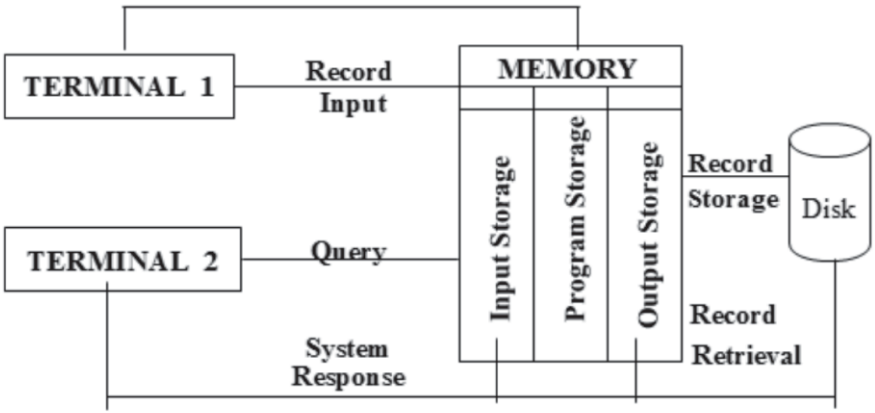
It is a non-sequential process in which data is directly transmitted between input/ output device and a computer system via communication links. It is a method of processing where many users have direct access to the same system, and where the file is updated as soon as the transaction is completed.

Special Features

1. In this method data is not accumulated, instead it is entered and executed directly.
2. Quick Processing - By means of direct communication with the computer and continuous flow of input, the delay between transactions and their processing is avoided.
3. This method reduces the data entry errors, because the user who generates, the data is the one who keys it in.
4. This system validates data at various points and ensures that correct data is being entered.
5. Under this method the system performs the whole task in a conversational 'manner helping the data entry process.
6. In on line processing, one has the latest update immediately.

Online processing ensures that the records are updated at any time whereas this is so with batch processing say once a week but the fact remains that online processing is usually more costly. Therefore in choosing one of the processing both updating of records and costs are to be considered.

CONCEPT OF ON-LINE PROCESSING



On-line Applications

Systems are being developed and are already in use for a wide range of application in different type of industries described below:

a. Electricity and Gas Boards: By means of terminals situated in showroom it is possible to inform perspective customers of the availability of the appliances in response to their inquiries.

b. Banking: It is possible to inform bank customers of the status of their accounts in response to an inquiry by accessing relevant file using online terminal.

c. Tour Operators Reservation Offices accept telephone inquiries from travel agents regarding the availability of holidays in respect of client's inquiries. By means of terminals, the availability of the required holidays can be checked and booked immediately.

d. Stock Exchange: Terminals located in major stock Exchange throughout the country and the offices of participating brokerage from enable the speedy processing of share dealings.

e. Stock Control: Terminals located in warehouse provide the means for automatic recording of stocks, updating of stock records, reservations, follow-up of outstanding orders and the printing of picking list etc.,

Benefits provided by Online Systems: Online systems provide a number of benefits all of which assist in improving administrative efficiency which is essential in today's competitive business environment. A number of benefits are out-lined below:

a. Integration of clerical work with the computer

On-line systems assist in harnessing activities of clerical staff to the computer by the use of terminals. They can have access to information which they require for the efficient performance of their jobs in dealing with customer enquiries and order processing.

b. Elimination of tedious tasks

Routine clerical tasks are replaced by terminal operations providing a greater degree of job interest, operating efficiency and job satisfaction.

c. Reduction in paper work

Volume of paper work generated by normal clerical system and batch processing system is relatively high. Online systems reduce the volume of print out required for management report since the information can be displayed on terminal screen on demand.

d. Improved accuracy

As terminal messages are checked accuracy before being transmitted to the computer by data validation programs, the quality of formation in a system increases as the input errors are reduced. Hence, information is more reliable.

e. File updating improved

Master files are more easily updated by terminal key board with regard to transaction data, as special runs do not require to be set up as is the case with batch processing applications.

f. Management Information more readily available

Management information becomes more readily available by direct access facilities which enable mangers to obtain a greater degree of control to the operations for which they are responsible.

g. Improved customer services

Improvements in the level of customer's service can be expected in these systems concerned with appliances sales, booking systems and accounting enquiries.

h. Reduced data preparations cost

On-line system dispense with the need to convert human sensible data into machine sensible data thereby eliminating punching and verifying operations. This saves time and the cost associated with such operations.

5. Real Time Processing

It is also called as interactive mode or direct mode. This system makes the user to have direct contact with the computer through his terminal. It is an alternative approach to an on-line processing system. Here the data is processed, the instant it occurs. There is no delay between the time data is

available, and the time it is processed.

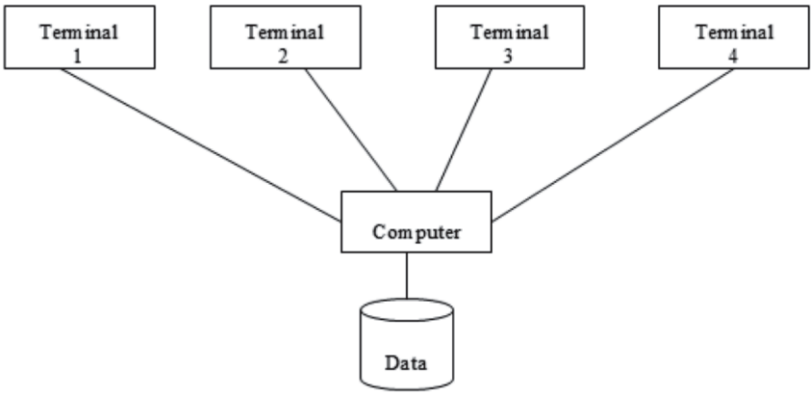
The term real time refers to the technique of updating files transactions date immediately after the event to which it relates occurs. This is in distinction to batch processing which processes related data to batches of pre-defined periods of time. Real time systems are basically on-line systems with one specially in inquiry processing. The response of the system to the inquiry itself is used to control the activity. An on-line production data collection system that simply accepts input and utilities it for payroll and costing purposes cannot be termed real-time, but if, on the other hand, the system is designed to provide immediate information to monitor the production processes, it is a real time system.

Special Features

(a) Program is always under execution.
(b) It produces output to control, direct or affect the outcome of an ongoing activity or process.
(c) In this method, the control is exercise during the actual functioning.
(d) It is meant exclusively to perform one task.
(e) It is like an online system with; title constraints on response time availability.
(f) It is called a real time system because it has to give results based on deadlines which are imposed by the real world outside.
(g) The data which has to be produced by the systems has to be in such a less time, that they can influence the external events which are based on this data.

Consequently the response of a real time system is one type of feedback control system. The response time would naturally differ from one activity to another. If the example, it is the launching of a space vehicle, the response time should be i split second whereas in business situation even a few minutes of response time may be alright. Online updating in real time usually leads to transaction as a by-product. For example, the updating in real time a customer's order may lead to such transactions as dispatch noted and purchase requests, etc. Real time systems offer accountants and others in business a chance to fulfill the potential of the computer as a tool of management.

Concept of Real Time Processing



Guided Rocket System

Real Time Processing is suitable in the following type of business operations:

i. Wholesale supplier and manufacture - Availability of stocks.
j. Airline - Flight seat availability.
k. Manufacturing - Status of production orders.
l. Process Control.
m. Space Craft Control.

Real time systems usually operated in multi-programming and multi-processing: This increases both availability and reliability of the system. CPU's in real time system should possess the, capability of what is known as program interrupts. These are temporarily stoppage or halts in the execution of a program so that more urgent messages can be handled on priority. It may be worth noting that some computers systems are dedicated to real time operations and others are designed to operate in both batch and real time modes so that they can also serve as stand by unit to each other.

6. Time Sharing

It is a special type of on-line processing in which several users share the resources of an on-line computer system to avoid turn about time, especially when results are needed quickly; another system is available

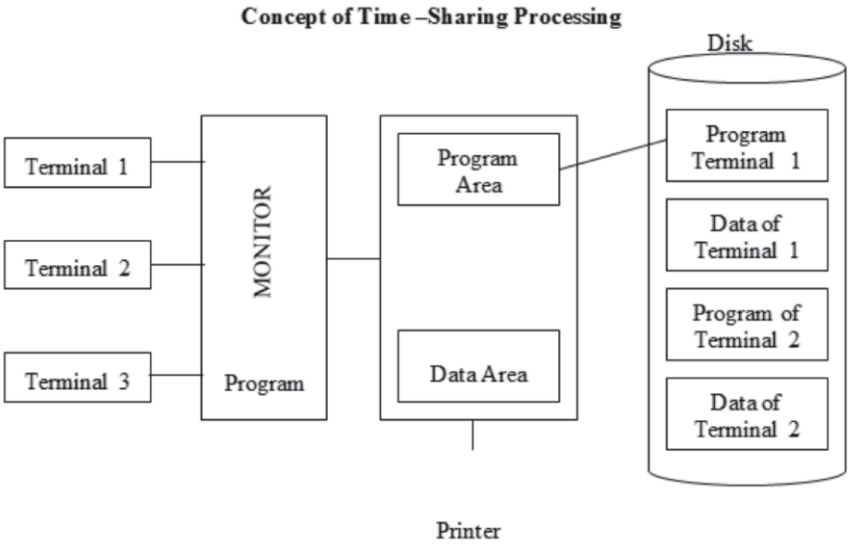
i.e., time sharing system. In this method the individual user has an independent local terminal. The terminal is connected to a main computer, which does all the processing work.

Under this system each person on a terminal has to log into the system. The system then lists him in the order in which he has logged on. Once everybody has logged on, the system will permit the first in the list to run his program. The time given for running the program is generally 10 milliseconds. It is called a time slice or a time slot or a quantum. Starting then, with the first to log on, each user is given his time slice. Once all have made use of it, the system starts all over again, repeating the cycle. The system maintained is called a polling system whereby each terminal is polled on a round robin basis.

All the instructions given by the users are carried to the centrally located main computer system and processed there and retrieve back by the user instantaneously. Since, the centrally located main computer has high-speed processor; users may feel that they are sharing the same computer resources.

Features

1. The processor time is shared between two or more persons.
2. The processor switches from one user's job to another at a rapid rate under the control of a monitor program.
3. This concept is time based.
   The concept of time-sharing can be explained with the help of the following diagram.



Let us suppose that there are three terminals, each person on a terminal has to log into the system. The system then lists him the order in which he has logged on. Once everyone has logged on, the system will permit the first on the list to run his program. The time given for writing a program is called a time slice or time slot. Starting from the first, each user is given his time slice. Once, all the three users have made use of it, the system starts all over again, repeating the cycle. The sequence maintained is called Polling System. Most time sharing systems respond to user's instructions in milli/micro seconds.

Advantages of Time-Sharing System

(1) Simultaneously several users can be served.
(2) All the users have the same priority.
(3) All the users get equal amount of processor time.
(4) The interaction with the running programs is possible.

Time-Sharing Vs Multi-programming

The difference between these two methods is that in "time, sharing" the CPU links only one terminal at a time and its total time is shared uniformly

by all the users. But in multiprogramming, the CPU links more than one terminal or other peripherals at a time. Therefore, multiprogramming more efficiently utilizes the main memory and the central resources than time sharing. Time sharing is employed only for multi terminal system whereas multi programming is meant both for single as well as the multi terminal system.

7. Distributed Processing

In computer science, a form of information processing in which work is performed by separate computers that are linked through a communications network. Distributed processing is usually categorized as either plain distributed processing or true distributed processing. Plain distributed processing shares the workload among computers that can communicate with one another. True distributed processing has separate computers perform different tasks in such a way that their combined work can contribute to a larger goal, such as the transfer of funds from one bank to another. This latter type of processing requires a highly structured environment that allows hardware and software to communicate, share resources, and exchange information freely. At the highest (and most visible) levels, such distributed processing can also require data transfer mechanisms that are relatively invisible to users but that enable different programs to use and share one another's data.

Distributed data processing system is a network of several computers in remote stations, each of which is linked to a single host computer. The larger, central computer maintains the firm's master data base and system log. Each remote system is a fully independent computer that maintains its own local data base in addition to communication with the master computer. These individual computers are tied together through a high speed communication network. This allows individual computers to communicate with one another in a variety of ways depending on the CIS requirements.

Many small computers (called nodes) are employed as data collection points in several departments. They are connected to a main computer system (called File Server) in a centralized department, which controls the entire database. The processing involved here is known as distributed

processing.

The distributed data processing system exists because of the need for large interactive installations with a high degree of reliability and accuracy. Moreover, large number of mini computers can be connected in this system which results in cost reduction.

Features

(a) Decentralized computer system
(b) Interconnected by communication network
(c) More reliable
(d) Since more than one computer is used in the network, it is economical.

Advantages

Distributed data processing system has many advantages:

a. Local computers on the network offer immediate response to local needs.
b. Systems can be expanded in modular fashion as needed because many small
c. Computers are used as the system is not dependent on large unit that could shut down the network if it failed.
d. Equipment operating and managing costs are often lower.
e. Minicomputers tend to be less complex than large systems; therefore, the system is more useful to local users.

Distributed data processing system a number of computer systems are linked together. So the facilities available-in one computer system can be shared by all. This link is called computer network.

8.3 CHAPTER SUMMATION

1. There are various methods of data processing such as the single user system, Batch processing, Multi-programming, On-line Processing, Real-Time processing, Time sharing concept, Distributed processing.
2. In batch processing data is accumulated and then processed.
3. In online processing data is not accumulated, instead it is entered

and executed immediately.

4. Real time processing is an interactive or direct mode. In this type of processing there is no delay in time between the availability of data and the time taken for processing.

8.4 DISCUSSIONS

1) What are the different methods of Data Processing? Explain.
2) List out the applications in which batch processing can be used.
3) What are the features of online processing?
4) List out the various benefits of on-line processing.

8.5 CHAPTER PROGRESS

Online – Railway reservation & Airline Reservation
Real time - Production process

CHAPTER NINE

NETWORKING

9.0 Aims and Objectives
9.1 Introduction
9.2 Advantages of Networking
9.3 Types of Network
9.4 Chapter Summation
9.5 Discussions
9.6 Chapter Progress

9.0 AIMS A OBJECTIVES

At the end of this lesson, you will be able to understand:

1. Computer networking
2. Types of networking
3. Advantages of Networking.
4. Various Topologies of LAN

9.1 INTRODUCTION

With standardized hardware and software, the microcomputers provide user-friendly environment. It meets the computing requirements of most users. But, the need for interaction with other computer users and with other computer systems for exchange of data etc. has increased over the inordinate length of time. Networks are increasingly meeting this need. From the users' point of view the networks may be of two types**:** ***Local area network and Wide area network.***

Computer networking is the process of inter connecting two or more computers so that the users can communicate with each other, share resources and overcome other limitations of stand-alone systems. The network can be established with a variety of combinations of computers

such as a net of only microcomputers, microcomputers and one or more minicomputers and a set of microcomputers connected to a mainframe computer. The computers in typical network are autonomous in the sense that they have processing capability independent of the network.

9.2 ADVANTAGES OF NETWORKING

The main advantages of networking are:

(i). Hardware resource sharing

Network enables sharing of expensive resources such as processor, storage space and peripherals like modern, fax, and laser printer.

(ii). Sharing of databases

The network permits concurrent access to the same data file by many users in the network. Thus, user in the sales department, production department, inventory department etc. share corporate databases.

(iii). Sharing of Software

Any user in a network can load and use the software installed on any of the computer of file server in the network.

(iv). Communication between users

The Network users can communicate between them. E-mail facility can also be used for communication.

(v). Decentralized data processing

In a network, the data processing can be decentralized by enabling local offices to capture and store data, and generate information to meet most of their requirements a local level itself.

(vi) Security of data

In a networked environment the data is backed up with duplicate storage. Adequate security measures are also put in place to protect the data.

9.3 TYPES OF NETWORK

The networks can be classified into three; local area network (LAN), metropolitan area network (MAN) and wide area network (WAN). They are explained in the following sections:

1. Wide Area Network (WAN)

WAN is made up of a number of autonomous computers distributed over a wide geographical area. WANs were originally developed in the late 1960s to enable communication between computer centers and sharing of hardware, software and other communication facilities. WAN can be implemented using private or public networks. In a private network an organization takes on lease telephone lines to connect such sites into a network. It is also possible to connect computers in different locations using microwave or satellite transmission. Public networks are installed by the Government owned telecommunication agencies. WAN spans large geographic distances. It is also called long-haul network. WAN is usually operated at lower speeds then MAN involves delay.

Most organizations use private networks for communication. Society for Worldwide Interbank Financial Transactions (SWIFT), a non-profit organization of banks, owns a private network. The network exchanges financial transactions between the participating financial institutions, about 3000 in number in over 60 countries. The terminals of these participating banks are hooked with SWIFT's access centers. The network offers data communication service 24 hours a day, 7 days a week.

INDONET, NICNET, SBINET and WELCOMENET are some of the private network in India. CMC's INDONET offers e-mail service to customers for a fee. NICNET is a network of National Informatics Center that connects all the district headquarters in the country. SBINET is a private network of State Bank of India and connects its branches across the country. WELCOMNET connects the hotels of the Welcome Group.

Features of Wide Area Network

A wide area network (WAN) is used to connect LANs and nodes that are separated by great physical distance. Generally speaking it is larger version of LAN with several differences:

1. It operates by means of the international telephone network
2. Unlike LANs which owned by their users, WANs operate on public and leased telephone lines provided by licensed common carriers, or by other means such satellite and microwave, which are

regulated by government agencies.
3. Data transmission is somewhere slower.
4. The WAN compose any of the following system configurations:
5. Single nodes
6. Clusters
7. LANs

Suppose a company has its central headquarters in Abuja, Nigeria and the Abuja site contains all departments and equipment for product manufacturing production distribution, accounting, and sales. The information pertaining to these operations is tracked by a single centralized database system. As the company becomes more profitable and expands, it establish additional sales offices in Lagos and Port Harcourt. Each sales office maintains its own system to record and track customer orders for its region. At the same time the two sites are linked to the mode at corporate headquarters and relay each order shipment and inventory and invoice processing.

Advantages of WAN

The integration of the local nodes into the distributed database linked by the WAN provides the following advantages:

1. The WAN allows access to the database at remote sites, enabling exchange of data.
2. If a remote node fails, the remaining nodes on the network can still exchange data.
3. If the network fails, the local mode can still access its own database.
4. The data used on daily basis by the sales offices resides at the local site, making it easier to retrieve quickly.
5. The local offices can maintain the data more effectively. The corporate office can access the data as needed.
6. As a site's database grows larger, its system's storage capacity can be easily upgraded without affecting the transfer of data between other nodes on network.

One of the most significant aspects of a wide area network when comparing it with freedom of a local area network is the involvement of a

public telecommunications authority. Regardless of whether the network is made up from system, the controlling authority is virtually always the public authority. In order to protect their equipment and employees, the authority lays down rules, which must be observed by anyone connecting to their lines. In most countries stringent requirements are also imposed on the characteristics of the data transmissions.

2. Metropolitan Area Network (MAN)

Metropolitan area network covers a wider area than a local area network. Usually MAN covers a large metropolitan city and is a scaled down version of wide area network. It operates at high speeds over distances sufficient for a metropolitan area.

3. Local Area Network (LAN)

A LAN is a system of interconnected microcomputers, sharing common resources like disks, printers etc., and links a number of computers workstations together to allow many people to use the same software and data files. Each user in such a multi-user environment accesses the resources through his microcomputer workstation. The network operating system integrates all the network components and makes operation smooth and transparent. LAN works in restricted geographical area such as within a large building or offices within a few kilometers.

The LAN is an interconnection of computers that need to communicate with each other in a limited geographical area. The network may have other sharable devices attached such as fax, laser printers and copiers. The network includes a central facility with huge storage capacity for the requirements of the organization. It also has a network operating system for managing the network.

Types of LAN

Local area networks are mainly of two types: Client/ Server LAN and Peer-to-Peer LAN.

a) Client / Server LAN

Client Server LAN has servers and clients. The server is a computer that manages shared resources: hardware as well as software and data. It is

usually a powerful computer with large RAM and secondary storage capacity. The LAN has a number of microcomputers, called clients, the request the server for services. The LAN may have many servers each specializing in one area of service such as file server, printer server, database server etc. A file server stores program and data files. A database server stores data and a printer server controls printers on the local area network.

b) Peer-to-Peer LAN

In a **Peer-to-Peer LAN** every computer is equal in status and functioning. All the computers on the network are capable of communicating independently with any other computer on the network without using a server. Thus, any computer on the network can access data and programs stored on any other computer. The peer-to-peer LAN is less expensive than client/server LAN. But at the same time this LAN may be slower than a client/server LAN.

LAN Topology

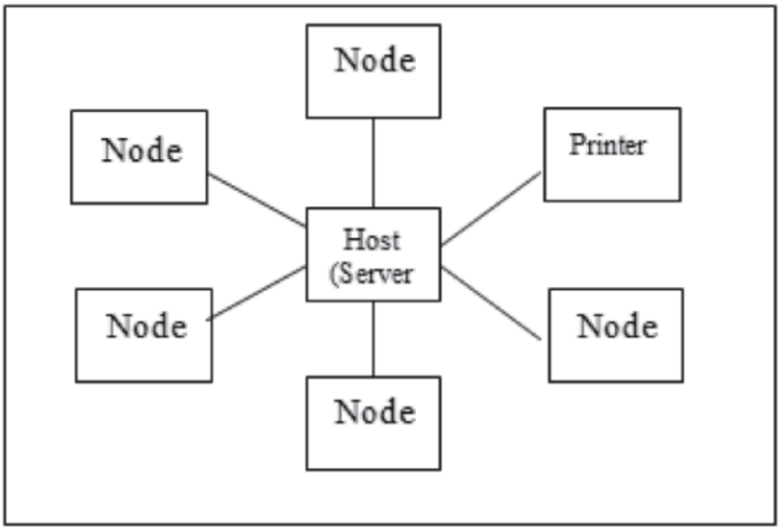
The design of network requires selection of a particular topology and architecture for the interconnection of network component.

Topology refers to the way the computers are physically connected into the network. The network architecture includes the specifications of the components that can be connected to the network. IBM's Systems Network Architecture (SNA) is an example of vendor developed network architecture. Such network architecture specifies network components such as terminals, workstations, printers, cluster controllers, host computer and communications controllers.

There are a number of network topologies. The ring, star and bus are popular network topologies.

a) Star Topology

In star network the nodes are connected to a central computer called the host computer. The nodes cannot communicate directly. Each node can communicate with the host computer. The host computer takes the message and routes it to the other node or nodes.



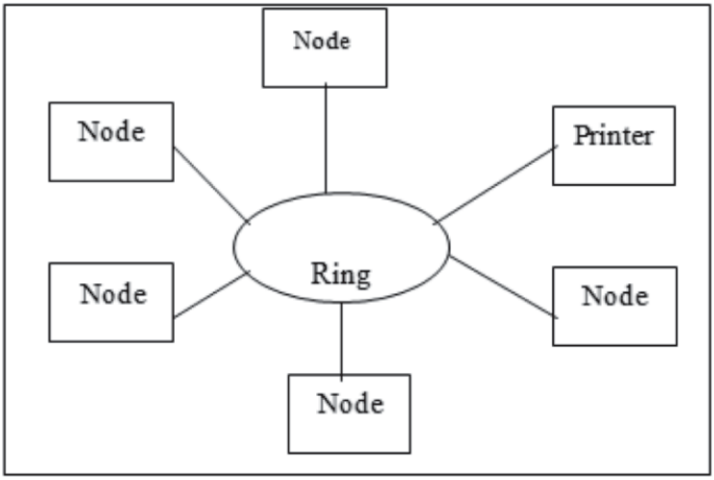
The host is the main computer to which other nodes are connected by communication links. The host computer is responsible for the overall functioning of the network. The node may be a microcomputer, terminal or any other device like storage device, printer etc.

In a star network centralization of control over the network resources is easy. It is also possible to network minicomputer or mainframe with other microcomputers and dumb terminals.

It eliminates single point failure of a common wire. If one of the host computers fails, it does not usually affect the others in the network. But the hub becomes a central point of failure in a ring network. If the host computer breaks down, the entire network breaks down.

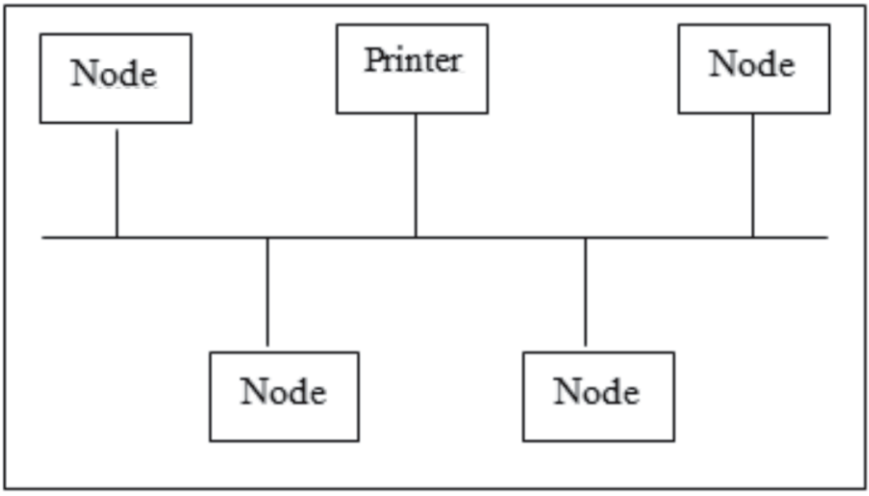
a) Ring Topology

In a ring network the computers can communicate directly with each other and also with the central computer. The nodes are connected to a line that is closed like a loop. The ring network is more reliable than star network. Even if the central computer in the network fails, the other computers can continue to communicate with each other.



a) Bus Topology

A bus network configures computers to a single non-looping channel. The computers connected to the network share the same bus or communication channel. Bus wiring is easy and needs much less wiring for small segments.



Old Ethernet bus wiring is prone to cable failure. If the bus wiring connection is broken at any point, the entire network fails.

a) Hybrid Network

In most cases, instead of a single topology, a combination of topologies may be used for greater flexibility and reliability. Hybrid network combines features of Star, Ring and Bus network:

Features of LAN

The features of LAN include the following

a) Limited geographical area say within a few kilometers.
b) Common communication link for sharing information, software and peripheral devices without regard to proximity of user to such resources on the network.
c) High transmission capability.
d) Low error rate as the network contains built-in component for detecting for system errors.
e) Private ownership by the user.
f) Not subject to regulation by the telecom service.

LAN interconnects computers and components within a limited geographical area. Such LANs are normally set up within a single site can have one or more business complex, a hospital, an office-building etc. The site can have one or more buildings but they should not be too far away, say less than 5 kilometers. A LAN can also include a variety of computer systems and devices such as workstations, microcomputer, file servers, plotters, scanners, graphic terminals and printers.

A large personal computer or minicomputer serves as the LAN's hub. A high capacity hard disk is attached to the hub as data files and software are stored on the network file server. The users can load the software on the file server and retrieve data files for processing. The output can be directed to the printer attached to the LAN.

Any communication network that meets most or all of the following characteristics can be classified as LAN:

a) All the devices on the network share a common transmission

medium, that is, the cable and/ or the controller.

b) The devices connected to the network can operate independent of the network.

c) Any device connected to it can communicate with any other device on the network.

d) The network is capable of supporting heavy data traffic over short distances compared to telecommunication network.

e) The network covers a limited area usually a few kilometers in compass or a single site like a university campus, an office or a factory.

LAN Components

The components of LAN are File server, workstation, network operating system, LAN cable, Active and Passive hubs etc.

a) Workstation

It is a single-user microcomputer with high power communication facilities. It can exchange message with other workstations or fileserver. Workstations can be of two types: user workstation and server workstation. User workstation is a microcomputer on the network, which is used to access the network. Service workstation performs service to process other workstations on the network. User workstation normally does not process requests from other workstations. Server workstation makes available all sharable network resources to other workstations. More than one server workstations may be added to the network such as printer server and fileserver. Normally the server workstation is the most powerful workstation. Server workstation may be dedicated or non-dedicated. In case of dedicated workstation, it is not available for other user applications. Non-dedicated server workstation doubles as an individual workstation and at the same time performs network-related functions.

b) File Server

File server is actually a process running on a computer that provides the clients access to files on that computer. The term is loosely applied to mean computer that runs file server software. In this sense, it is a powerful computer with special software to serve files to other workstations on the network. The files, which may be program files or data files, are

simultaneously shared by a number of workstations. Cisco IOS would be the **most** prevalent **network** device **operating system** in the United States presently. Cisco's devices currently have approximately 80% of the market share in the continental United States. Novell Netware is also a popular network operating system.

c) Gateway

The gateway assists in communicating between LANs. A workstation may be dedicated to serve as gateway. This is required particularly when two networks with different technologies have to communicate with each other. Gateway may also be used to connect LAN with a mainframe computer.

d) Network Interface Unit

The network interface is a printed circuit board installed in the microcomputer. It may be called network card, network adapter or network interface unit. It connects the workstations functionally and physically with the network.

e) Active Hub

Hub is an electronic device to which multiple computers are attached usually using twisted pair cables. Active hub is a powered distribution point with active devices that drive distant nodes up to one kilometer away. It can connect up to eight nodes on the network. The maximum distance carried by an active hub is about 2000 ft.

f) Passive Hub

This hub is a distribution point that does not use power or active devices in a network to connect up to four nodes within a short distance. The maximum distance covered by a passive hub is nearly 300 ft.

g) LAN Cable

LAN requires superior cable capable of transferring data at high speed. Coaxial cables or fiber optic cables may be used for networking computer.

h) Network Operating System (NOS)

The NOS integrates all the network components. The NOS facilitates file

and print serving along with other functions like communications and e-mail between workstations. In most LANs the NOS exists along with the computer's operating system. The computer's operating system processes the system requests first and processes them if they can be done with the workstation resources. If it is not a local request, meaning that the network resources have to be used, the request is transferred to NOS for carrying out. Thus, the NOS are responsible for controlling access to data, storage space and sharing of other peripheral resources.

i) Applications Software

Another component of LAN is application software. It has to be ensured that the application software works in the multi-user environment.

j) Protocols

Data transmission between devices requires protocol. Protocols are sets of rules and procedures to control the data transmission between computer and other devices. They are common technical guidelines for communication between devices. They specify the order in which signals will be transferred, the signal for completion of transfer etc. Only Devices using the same protocol can communicate directly. Both the sending and receiving devices must use the same protocol for effecting communication. For communication between devices using different protocols requires intermediate interpretation device or software.

The protocol performs the following functions:

a) Set up a link with the other device in the communication.
b) Identify the component to other components in the communication (sending device's channel ID)
c) Send and interpret the data
d) Provide a continuous feedback on data transmission like data is not being received and understood.
e) Request for retransmission of garbled data.
f) Engage recovery procedure when error occurs.
g) Provide an acceptable way of terminating transmission so that all devices have completed the process.

The protocol is embedded in communication software designed to use a

particular protocol. The user need not bother about the protocol as the components involved in the communication perform the protocol matching. The data communication protocols are of two main types: asynchronous and synchronous. The synchronous protocol permits continuous data transmission. The devices in communication must be synchronized with the other. The transmission is governed by a time interval and not by start-stop bits. For example, clock, in the modern, sets the time interval.

9.4 CHAPTER SUMMATION

1. Computer networking is the process of inter connecting two or more computers so that the users can communicate with each other, share resources and overcome other limitations of stand-alone systems.
2. A wide area network (WAN) is used to connect LANs and nodes that are separated by great physical distance.
3. The LAN is an interconnection of computers that need to communicate with each other in a limited geographical area.

9.5 DISCUSSIONS

1) Discuss the various advantages of a computer network.
2) Explain in detail the different types of network.
3) List out the features of a) WAN; b) LAN
4) Explain in detail about various LAN Topology.
5) Discuss in detail about the different computers of LAN.

9.6 CHAPTER PROGRESS

Peer-to-Peer LAN:
Client / Server LAN

CHAPTER TEN

THE INTERNET

10.0 Aims and Objectives
10.1 Introduction
10.2 What Is the Internet
10.3 The Word Wide Web (www)
10.4 Internet Communication
10.5 Connecting To the Internet
10.6 Web Browser
10.7 Wireless Security
10.8 Understanding How Email Addresses Works
10.9 Chapter Summation
10.10 Discussion
10.11 Chapter Progress

10.0 AIMS AND OBJECTIVES

After studying this lesson, you will be able to understand:

1. How the internet works.
2. Setting up a local internet connections for our homes and offices.

10.1 INTRODUCTION

It's no secret that more and more the internet is becoming an integral part of our everyday lives. But if you are new to the online experience, it may be a bit prodigious. You may be wondering, "What exactly is the internet, and how does it work?" In this lesson, we will be looking at a brief overview of the internet, and we will see some fundamental concepts such as networks, servers, and clients.

In the early days, most people just used the internet to search for information. Today's internet is a constantly evolving tool that not only

contains an amazing variety of information, but also provides new ways of accessing, interacting and connecting with people and content. As a result, new terms are constantly appearing as new technologies are introduced.

10.2 WHAT IS THE INTERNET?

The internet is the largest computer network in the world, connecting millions of computers. A network is a group of two or more computer systems linked together. There are two main types of computer networks mainly which I earlier gave some highlights in chapter 9. The Local Area Network (LAN): A LAN is two or more connected computers sharing certain resources in a relatively small geographic location, often in the same building. Examples include home networks and office networks. A WAN typically consists of two or more LANs. The computers are farther apart and are linked by telephone lines, dedicated telephone lines or radio waves. The internet is the largest Wide Area Network (WAN) in existence.

You may have heard someone say something like "The server is down" or "We're having problems with the e-mail server." A server is a computer that "serves" many different computers in a network by running specialized software and storing information. For example, web pages are stored on servers. When you access a web page, your computer is acting as a client. A client runs familiar software such as web browsers or email software, and it communicates with the server to get the information it requires. In order for your browser to display a web page, it requests the data from the server where the page is stored. The server processes the request, and then sends the data to your browser, where it is displayed.

10.3 THE WORLD WIDE WEB (WWW)

When most people think of the internet, the first thing they think about is the World Wide Web. Nowadays, the terms "internet" and "World Wide Web" are often used interchangeably— but they're actually not the same thing. The internet is the physical network of computers all over the world. The World Wide Web is a virtual network of web sites connected by hyperlinks (or "links"). Web sites are stored on servers on the internet, so the World Wide Web is a part of the internet. The backbone of the World Wide Web is made of HTML files, which are specially-formatted

documents that can contain links, as well as images and other media. All web browsers can read HTML files. In addition to HTML, it's also very common for websites to use technologies like CSS (Cascading Style Sheets) and JavaScript to do more advanced things. As I often say to my student in class, the HTML is the skeleton of a website. To get to a web page, you can type the URL (Uniform Resource Locator) in a browser. The URL, also known as the web address, tells the browser exactly where to find the page. However, most of the time, people get to a web page by following a link from a different page or by searching for the page with a search engine. The World Wide Web was created in 1989 by Tim Berners-Lee, a software engineer. Before then, computers could communicate over the internet, but there were no web pages.

10.4 INTERNET COMMUNICATION

The internet isn't just about finding information. It's also about connecting with friends, family, and people you've never met before. Today, there are many different ways to communicate online, including social networking, chat, VoIP, and blogging. Social networking has become one of the main ways people keep in touch. We now have the most popular social networking sites like Facebook. Facebook is used by about one billion people. If you have family or friends that live far away, you can use Facebook to keep up with their lives. You can also share things you've found online that interest you as well. We also have Twitter. Twitter lets you share brief messages (or "tweets") with the entire world, or with just your circle of friends. By following people with similar interests, you can discover new things that you wouldn't have found otherwise. Then we have LinkedIn. LinkedIn is a site that you can use for business networking. It allows you to connect with other people in your field and find out about new job opportunities.

10.5 CONNECTING TO THE INTERNET

Once you've set up your computer, you'll probably want to get internet access so that you can send and receive email, browse the web, watch movies, and more. Before you can access the internet, there are certain things that you will need: internet service, a modem, and a web browser. It all depends on where you live and how much speed you need. Internet Service Providers (ISP) usually offer different levels of speed based on

your needs. If you're mainly using the internet for e-mail and social networking, a slower connection might be all you need, but if you want to download a lot of music or watch streaming movies, you'll want a faster connection. You'll need to do some research to find out what the options are in your area.

Once you have decided which type of internet access you are interested in, you can determine which ISPs are available in your area that offer the type of internet access you want. Then, you will need to purchase internet service from one of the available ISPs. Talk to friends, family members, and neighbors to see what ISP they use.

Once you have your computer, you really don't need much additional hardware to connect to the internet. The primary piece of hardware you need is a modem. The type of internet access you choose will determine what type of modem you need. Dial-up access uses a telephone modem, DSL service uses a DSL modem, cable access uses a cable modem, and satellite service uses a satellite adapter. Your ISP may give you a modem (often for a fee) when you sign a contract with them, which helps to ensure that you have the right kind of modem. However, if you would prefer to shop for a better or cheaper modem, then you can choose to buy one separately.

A router is a hardware device that allows you to connect several computers and other devices to a single internet connection, which is known as a home network. Many routers are wireless, allowing you to easily create a wireless network. You don't necessarily need to buy a router to connect to the internet. It's possible to connect your computer directly to your modem using an Ethernet cable. Also, many modems now include a built-in router, so you have the option of creating a network without having to buy more hardware. Most routers also act as a hardware firewall, which helps prevent people from gaining access to your computer through the internet.

A network card is also another piece of hardware that allows computers to communicate over a computer network. Most new computers have a network card built into the motherboard, so it's probably not something you will necessarily need to purchase. The network card will either have an

Ethernet port, a wireless connection, or both. If you have a laptop with a wireless connection, you can access the internet at any place that offers a Wi-Fi connection. Many restaurants, coffee shops, bookstores, hotels and other businesses offer free Wi-Fi. In addition, many cities provide free Wi-Fi in public areas such as parks and downtown areas.

10.6 WEB BROWSER

A web browser is the tool that you use to access the World Wide Web. The browser's main job is to display web pages. It also lets you create Bookmarks (sometimes called Favorites) for sites you like, so that you can easily find them again later. The World Wide Web is a virtual network of web sites connected by hyperlinks (or "links"). Web sites are stored on servers on the internet, so the World Wide Web is a part of the internet. Your computer probably came with a browser pre-installed. PCs come with Internet Explorer, and Macs come with Safari. If you prefer to use a different browser, you can download Firefox, Google Chrome, or Opera. All of these browsers are free.

Once you have chosen an ISP and purchased the appropriate modem, you can use the instructions provided by your ISP (or included with the modem) to set up your internet connection. Depending on what type of service you have, your ISP may need to send a technician to your house in order to turn the connection on. After you have everything set up, you can open your web browser and begin using the internet. If you have any problems with your internet connection, you can call your ISP's tech support number.

10.7 WIRELESS SECURITY

A home network can be wired (using Ethernet cables) or wireless (using Wi-Fi). It may also be a mixture of the two, with some devices connecting with Ethernet and others connecting wirelessly. Wireless is generally more convenient; however, you'll need to think about wireless security. Below are some important securities terms that you'll need to know:

SSID: A service set identifier, commonly called the SSID, is the name of a wireless network. You should change the default SSID to something

unique that you'll remember. You may not want to use your actual name, but you can use a hobby or other interest (for example, NIA001).

ENCRYPTION PASSWORD: An encryption password is a series of characters that is used to control access to the network. For even greater security, some people use a passphrase, which is longer (and therefore more secure) than a password. You should choose a password or passphrase that's easy for you to remember, but hard for other people to guess.

ENCRYPTION: Encryption prevents unauthorized people from reading the data that is transmitted over your wireless network. The data is coded into an unreadable form, and it can only be decoded by a computer that has the correct password (or passphrase). The most common types of encryption for wireless networks are WPA (Wi-Fi Protected Access) and WPA2. Although it's possible to create a wireless network that doesn't have a password, it is very risky. You should always create a password or passphrase to protect it from unauthorized access.

10.8 UNDERSTANDING HOW EMAIL ADDRESSES WORKS

To receive emails, you will need an email account and an email address. Also, if you want to send emails to other people, you will need to obtain their email addresses. It's important to learn how to write email addresses correctly, because if you do not enter them exactly right, your emails will not be delivered or they might be delivered to the wrong person.

Email addresses are always written in a standard format that includes a username, the @ (at) symbol and the email provider's domain. The username is the name you choose to identify yourself and the email provider is the website that hosts your email account.

In the past, people usually received an email account from the same companies that provided their internet access. For example, if Qserver provided your internet connection, you'd have a Qserver email address. While this is still true for some people, today it's increasingly common to use a free web-based email service, also known as webmail. Anyone can use these services, no matter who provides their internet access. Today, the

top three webmail providers are Yahoo!, Microsoft's Hotmail, and Google's Gmail. These providers are popular because they allow you to access your email account from anywhere with an internet connection. You can also access webmail on your mobile devices.

Many people also have an email address hosted by their company, school, or organization. These email addresses are usually for professional purposes. For example, the people who work for this website have email addresses that end with @nicholasibenu.com, if you are a part of an organization that hosts your email, they'll show you how to access it. Many hosted web domains end with a suffix other than .com. Depending on the organization, your provider's domain might end with a suffix like .gov (for government websites), .edu (for schools), .mil (for military) or .org (for non-profit organizations).

Many companies and organizations use an information management application, like Microsoft Outlook, for communicating and managing their email. This software can be used with any email provider, but is most commonly used by organizations that host their own email.

10.9 CHAPTER SUMMATION

The Internet has turned our existence upside down. It has revolutionized communications, to the extent that it is now our preferred medium of everyday communication. In almost everything we do, we use the Internet. Ordering a pizza, buying a television, sharing a moment with a friend, sending a picture over instant messaging. Before the Internet, if you wanted to keep up with the news, you had to walk down to the newsstand when it opened in the morning and buy a local edition reporting what had happened the previous day. But today a click or two is enough to read your local paper and any news source from anywhere in the world, updated up to the minute.

10.10 DISCUSSION

Discuss the benefit of the internet and give an extreme view of how the internet has contributed to our lives and what the future holds for the 21st century generation.

10.11 CHAPTER PROGRESS

The **Internet** has offered people varieties of **benefit** to connect with others around the world. There are various online services that help you to communicate and work with other people all over the world. Also, it can make services and producing new products easier and faster.

CHAPTER ELEVEN

DANGERS OF WIRELESS CONNECTION AND NETWORK INFILTRATION

11.0 Aims and Objectives
11.1 Introduction
11.2 Dangers of using Open Wireless
11.3 Secure Yourself from Public Wireless
11.4 Most Common Digital Attack
11.5 A Tour on Network Infiltration
11.6 Chapter Summation
11.7 Discussions
11.8 Chapter Progress

11.0 AIMS AND OBJECTIVES

After studying this lesson, you will be able to understand:

1. The benefits of a wireless network
2. Security risks, Examples of vulnerabilities, Methods to protect your computer from intrusion.

11.1 INTRODUCTION

Over the past five years, the world has become increasingly mobile. As a result, traditional ways of networking the world have proven inadequate to meet the challenges posed by our new collective lifestyle. If users must be connected to a network by physical cables, their movement is dramatically reduced. Wireless connectivity, however, poses no such restriction allows a great deal more free movement on the part of the network user. As a result, wireless technologies are encroaching on the traditional realm of "fixed" or "wired" networks. The reasons why people moved to wireless connection is to overcome the physical limitations of the internet access. But from attackers view, wireless connections are easy to target and intercept.

11.2 DANGERS OF USING OPEN/PUBLIC WIRELESS

People are always eager to use free wireless without considering the dangers that come with it. We are going to be looking at some of the factors and risk of using a public Wi-Fi.

1. Man in the Middle Attack (MITM)

This can be described as a way in which an attacker intercept the connection between two systems i.e. the access point and the victims. (Free Wi-Fi) in a public place and you quickly connect to it. The attacker has his own motive for creating this; to spoof your entire browsing history, including your usernames and password later on sells it in the dark web.

Another method is when you connect to a public wireless from a restaurant, airport, or an open space and you are browsing through Facebook and Gmail. Since these sites are both encrypted with HTTPS, the assumption is that it is secure and no one can intercept your communication on a secure site. The hacker intercepts this network through an attack called SSL stripping.

DNS Catch Poisoning is another method similar to SSL Stripping, for instance you want to browse Facebook, your computer sends request to the wireless router to Facebook and the router sends back response to your computer with Facebook. But with DNS Cache Poisoning, the attacker is the one between the connection i.e. the wireless connection and your computer.

When you browse Facebook, instead, of your computer to communicate with the free wireless connection directly it will pass through the attacker's computer/phone, then to the Access point, get response from the wireless connection back to the attacker's computer/phone, then back to you. With this he will automatically be given the privilege to do modifications right from his computer so that whenever you browse Facebook or Gmail it may appear to you as Facebook but if you look closely, it is just a phishing site.

11.3 SECURE YOURSELF FROM PUBLIC OPEN/WIRELESS

If you want to use a public connection always check that your website is

accurate. That is what most people do not do, it is always safe to browse on HTTPS site as I have mentioned earlier. Do not carry out transactions with your bank online as that is one of the main reasons for an attacker to intercept your connection. If you would want to do that get yourself a wireless connection. (Do not forget to turn off your wireless connection when it's not in use).

SECURE YOURSELF WITH VPN

To protect against this type of attack you should use a VPN to make your online activities safe, secure and encrypted. There are many VPNs available on the internet; we have VyprVPN, Hide My Ass, OpenVPN and VPNGate. For this purpose, we would talk about VPN Gate.

VPNs allows you to securely connect to remote networks through the internet, grant secure connections of multiple networks, and help boost your online security and privacy.

VPN Gate is a free, non-commercial 'Academic Experiment Project' developed by the University of Tskuba. The VPN Gate Network consists of VPN relay servers located all over the world.

11.4 MOST COMMON DIGITAL ATTACK

It seems that there are more news reports every day about how hackers have broken into the networks or website of a company or government department and it happens everywhere around the world. But one of the questions often asked by people is; how do hackers do it? I am going to be explaining the steps, and the ones they use depending on the nature of the attack.

1. **Reconnaissance:** the hackers try to find out basic but important information about the system being targeted. For instance, they need to know the operating system, if there's a firewall, what connection port are open, what content management system (CMS) is used, and the identity of the main users. A hacker will know how to harvest this information from open sources such as social media networks and search engines.

2. **Known Vulnerabilities:** a number of online sources publish information about different system's security weakness and as a way of establishing bona fides, will also frequently publish the code that was used to attack the system. Hackers will use this information in planning and executing their attack.

3. **SQL Injection:** this type of attack work by manipulating the database queries that the web application sends. An application can be vulnerable if it does not sanitize user's input properly or uses untrusted parameter values in database queries without validation.

   Some of the ways of protecting against SQL Injection are;
   - Using parameterized SQL
   - Sanitizing/validating all untrusted parameters before using them in database operation
   - Using tested and code review libraries for database operations.
   - Using least privilege for database access (never let application use administrator user for database access)

4. **Phishing:** this is one of the oldest attacks but it is still very effective today. The attacker normally sends out a lot of spam email to many people, and the message contains links to fraudulent websites that has been made to look like, a bank's website, for example. The message will ask the reader to enter some type of sensitive credential, which the fake website will capture and enable the attacker to impersonate the recipient or steal other valuable information or in the case of payment card details. To best protect yourself from this type of attack, do not click on a link in an email message from an unknown person, or in a suspicious looking message. If you want to verify any requests, for credential such as your password, always type in the link directly into your browser and verify the information on the browser that loads.

5. **Spear Phishing:** This is a type of Phishing attack, but directed at a particular person or organization. The email message will contain information that will convince the recipient that they know the person in question, as a way of trying to establish trust.

6. **Malware:** Malware is a malicious software installed on your computer, mostly without your knowledge. This happens when an attacker sends out phishing emails with attachment containing the malicious code, or if you click on a file containing malware from a website.

   Avoid clicking on illegitimate links to win, download free antivirus, instant prize draw, etc…

7. **Weak Authentication:** Poor security such as weak passwords, insecure password reset methods, or allowing an indefinite number of invalid login attempts. A strong password is one that is difficult to get or figure out.

11.5 A TOUR ON NETWORK INFILTRATION

HOW DOES CRIMINALS GET THROUGH THE NETWORK?
Now let's take a tour on how these criminals infiltrate your Network. Once you understand how hackers get around firewalls, you will be in a better position to defend your business from cyber-attacks.

Network security solutions are getting more and more sophisticated every day, offering rapidly increasing levels of protection in ever more efficient and affordable ways. Yet sometimes, cybercriminals can still find a way into the well-defended IT infrastructures.

You must have wondered how they manage to do that. What vulnerabilities do hackers use to get around apparently this protected network security defences? And what security solutions are available to counteract them?

I am going to be showing you some few common methods that cybercriminals use to circumvent network security. But it's not all doom and gloom – we'll discuss how to keep these risks at anchorage too.

ENCRYPTED INJECTION ATTACKS
This kind of exploit is particularly dangerous for companies with older firewalls

or those that don't use a feature called “deep packet inspection” or DPI.

A firewall with DPI will inspect all of the data packets entering and leaving your network to check for malicious code, malware, and other network security threats.

Encrypted injection attacks are usually delivered via phishing emails. The email will trick the user into clicking a certain link that injects encrypted code onto the machine – this can be regular malware, fileless malware, or some kind of data access backdoor.

The phishing link may also ask the user for login credentials (or other sensitive information) as well as delivering its encrypted payload for a cyber-attack operation.

Older software systems are less well equipped to adequately inspect and filter encrypted traffic. Modern DPI-enabled firewalls stand a much better chance of dealing with encrypted threats, but as yet unidentified (“zero-day”) threats can still slip through the net.

The fight against encrypted injection attacks is a great example of how cyber security training, modern firewall solutions, and strong antivirus protections work together hand in hand.

DNS LEAKING

A firewall's job isn't just to inspect *incoming* traffic; it's there to make sure nothing unexpected *leaves* the network too. In my experience, an alarming number of enterprise firewalls are configured to inspect traffic *coming in* but neglect to keep an eye on the data that's *leaving* the network. This is a trance development for a cybercriminal.

Although getting into the network may prove a challenge, once they're in they can leak data back out however they wish. If your firewall isn't inspecting what's leaving the network, it won't detect a problem.

A smaller number of organisations have a slightly savvier network security setup, but one that's still open to abuse. These networks limit the kinds of

traffic that can leave the network, only allowing outgoing traffic via three protocols – HTTP, HTTPS, and DNS which are all necessary for internet access. Though this method means that a hacker wouldn't have the same choice of exits as in our previous scenario, data can still be leaked through DNS – although rather slowly.

If your firewall is allowing *all outgoing DNS movement*, then this could become an issue. So, make sure that your firewall is covering all of your bases – both incoming and outgoing.

NEIGHBOUR WI-FI ACCESS POINTS

If your organisation's Wi-Fi is sometimes a little slow or if staff wants to circumvent your network security policies, members of your team may simply switch to an available open Wi-Fi network that's probable nearby.

For example, if your office is next door to a coffee shop, it's likely that your staff will occasionally hop between the coffee shop's open network and your (hopefully) secure one.

However, this can open up a whole canister of cyber security worms. When a member of your team joins a network that is outside of your organisation's direct control, they're actively circumventing your company's security policies.

You see, *anybody* can connect to an open network, including cybercriminals. If a hacker is trying to target your company, they may join a neighbouring open network and wait for one of your team to join that network too.

Once a team member joins the open network, there's hypothetically nothing in place to stop the hacker from listening in on their communications or even attempting to access your network via the user's device.

Two cybersecurity systems offer solutions here: Virtual Private Networks (VPNs) and Intrusion Prevention Systems (IPSs). We already had some discussion on the virtual private network earlier but it is important we lay

emphasis on it as it seemingly important in protecting our networks. A virtual private network extends a private network across a public network and enables users to send and receive data across shared or public networks as if their computing devices were directly connected to the private network. VPNs are a must if your staff frequently access external networks as they encrypt all traffic between their device and your network. If someone wanted to snoop in on communications, all they'd see is useless gabble.

INTRUSION PREVENTION SYSTEMS

An Intrusion Prevention System (IPS) is a network security/threat prevention technology that examines network traffic flows to detect and prevent vulnerability exploits IPSs continually monitors your network for potentially out of the ordinary or unnecessary network behaviour. Once detected, the IPS will either block this behaviour or alert an engineer to investigate immediately.

IOT ATTACKS

The Internet of things (IOT) describes the network of physical objects (things) that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the Internet. If you use a smart watch or voice-operated smart speaker, then you're already somewhat familiar with the “Internet of Things” or IoT.

Many businesses are welcoming internet-enabled devices – of wildly varying complexity – into the workplace, including cloud-enriched access control systems and smart lighting and heating solutions.

Integrating online features into these devices gives us a level of convenience and control that we would have only dreamed of 20 years ago. Yet, without proper protections, IoT systems have their downsides.

Instead of hacking Target’s networks directly, the cybercriminals will rather prefer to infiltrate their air conditioning supplier. The air-con systems used by the retailer will be internet-enabled and this - alongside a spot of phishing - is how the hackers made their way into Target’s systems.

The problem with IoT device software is that it's often lightweight, scarcely including any kind of security measures. With this in mind, you should NEVER connect an IoT device directly to the internet – no matter how small or innocuous the device may be. Always make sure it's safely "behind" your firewall, IPS, and any other cyber security solutions that you use.

SOCIAL ENGINEERING

In this context, social engineering is the psychological manipulation of people into performing actions or divulging confidential information. Even with the most stringent network security measures in place, hackers can still find a way into your network. Skilled cybercriminals can easily use your psychology against yourself.

Now, let us put it in simple terms. Social Engineering is the study of manipulating people into doing things, through persuasion, coercion, loss aversion, curiosity, or sometimes outright threats and blackmail. It's almost like "people hacking" if you wish to say.

Sending an authentic-looking phishing email is a common way of extorting information, and is an example of social engineering. A cybercriminal may deliberately leave an infected USB stick in the company car park to tap into our innate, natural curiosity – not to mention our innate, natural sense of "finders keepers"; this is called "baiting".

Attacks can also happen over the phone, with a criminal calling in and pretending to be a supplier needing confidential information to verify someone's identity, for example. There are numerous social engineering methods out there, so it pays to stay observant.

Network security systems always work in logical, predictable ways. Sadly, humans don't. Although cyber security provisions are essential, there's no replacement for good cyber security awareness training. A well-informed workforce could be the one thing that foils a criminal's plans!

STEGANOGRAPHY

When we hear the word steganography what first comes to our mind?

"Cryptology" right? Steganography is the practice of concealing a message within another message or a physical object. In the computing/electronic contexts, a computer file, message, image, or video is concealed within another file, message, image, or video. Where cryptography is the study of encrypting and decrypting messages, steganography is the study of concealing the fact that a message has been sent at all.

All manner of threats can be hidden in seemingly innocent-looking files. Whether it's a file purporting to be a legitimate app installer, a video of a charming puppy, or the latest meme doing the rounds, that file could secretly be laden in an executable malware.

When a payload has been crudely inserted into the innocent "carrier" file, it's still possible that sometimes it will be picked up by up-to-date security software (it is important we keep our software up to date). Some firewalls don't look at files over a certain size. With this in mind, smart hackers will often "pack" the file with useless nonsense, so the firewall overlooks it and lets it slide right through.

However, many modern firewalls feature "stream-based" deep packet inspection. Instead of assessing each file as an assembled whole, these solutions inspect each packet as it comes in – even if you've downloaded 99% of the file, it'll pull the plug if it detects something fishy within it. Cloud-enabled, unlimited sandboxing is another feature common to modern firewalls that can help here; it runs each new file through a test environment to see if it does anything unexpected or dangerous.

We must all employ all necessary strategies that will help to secure our lives and businesses. Without keeping security at our fingertips the repercussion of what it will end us, will be an unimaginable trauma. Let us take security seriously!

11.6 CHAPTER SUMMATION

The above few mentioned methods are just few common ways in which hackers can break into websites or computers. Everyone must bear

responsibility for their individual and their organization's security, and know the latest methods of attack.

11.7 DISCUSSIONS

1. Write short notes on how a hacker can smoothly gain access to an email address.
2. What are the benefits of using a VPN on the internet?

11.8 CHAPTER PROGRESS

- Avoid clicking on illegitimate links to win stuff, download free antivirus, instant price draw, etc.
- Never reveal your personal details like your name, partners name, hobby, and username, bank details to anyone via email or a phone call.

CHAPTER TWELVE

COMPONENTS OF COMPUTER AND THEIR FUNCTIONS

12.0 Aims and Objectives
12.1 Introduction
12.2 Input Unit
12.3 Output Unit
12.4 Chapter Summation
12.5 Discussions
12.6 Chapter Progress

12.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. The basic concepts & various types of input devices
2. The basic concepts & various types of output devices

12.1 INTRODUCTION

We generally refer to a computer as a system (Computer System) since computer is made up of integrated components: input and output devices, storage, Central Processing Unit etc. that work together.

The main components of a computer system are:

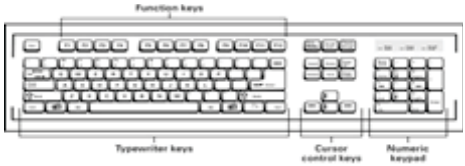
(1) Input Unit
(2) Output Unit
(3) Storage Unit(discussed in chapter 3.2)
(4) Central Processing Unit (CPU) (the Control Unit and Arithmetic Logic Unit of a Computer System are jointly known as Central Processing Unit(discussed in chapter 3.2)

12.2 INPUT UNIT

The input unit is used for entering the data and instruction into the computer for performing computation of the data. The input unit accepts or

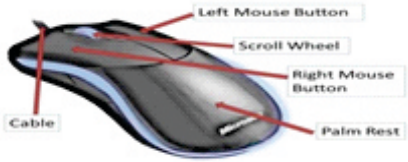
reads the list of instructions and data and converts these instructions and data in computer into acceptable form. It supplies the converted instructions and data to the computer for further processing. The devices used for this purpose are called as Input Devices. Keyboard and Mouse are the important input devices used in our offices. Light pen, Joy stick, Track ball, Touch pad, Scanner and Pointing stick are some of the Input Devices.

a) Key Board



The keys in Computer keyboards are almost similar to the keys in a typewriter but in addition there are some special operational keys carrying special symbols that help us in giving instructions to computer.

b) Mouse



The mouse is an essential component in the modern computers which use windows and other Graphical Use Interface (GUI) applications.

The mouse is a small service in which a small ball is kept inside and the ball touches the pad through a hole at the bottom of the mouse. When the mouse is held in hand pushed along a flat surface (mouse pad), the ball inside the mouse rolls and this movement of the ball is converted into electronic signals and sent to the computer, now we get advanced versions of mouse like optical mouse, scroll mouse cordless mouse etc. using the mouse the cursor (the small blinking vertical line we see in the monitor) can be moved in any direction. The mouse is used for selecting part or full text or object, and also for dragging and dropping the selected text or object.

How to handle the mouse

When we slide the mouse left across the mouse pad the mouse pointer of the screen moves left on the screen. When we slide it right the pointer moves right. When the mouse is moved forward or backward, it causes the pointer to move up and down. The following actions are performed with the mouse:

Clicking

Keeping the mouse pointer at any position, if we click the mouse button the cursor will move to that position.

Selecting

To select a text for copying or deleting, keeping the mouse pointer at the beginning of the text, click the mouse button (left button) and without releasing the finger move the mouse till the end of the text and then release the finger. The text thus selected is highlighted and can be copied or deleted.

Dragging

After selecting the text as above, bring the mouse pointer at the selected text; press the left mouse button with the finger and without releasing the finger drag the selected text to any desired position.

Right clicking

By pressing and releasing the right mouse button, the short cut menu is activated.

c) Scanner

Scanner is an image acquisition device connected to the computer, which captures either an image of a text document or a picture and transfers it into bits of information, which a computer can understand and manipulate.

How does a scanner work?

The scanner uses a light source, typically a cold cathode lamp to illuminate the scanned object. The light is then reflected off the object and into Charged Coupled Device (CCD). The Charged Coupled Device collects the information, and through a series of electronic devices converts the

analog signal into a series of digital signals which can then be read and processed by a computer.

Uses of scanners

Optical Character Recognition OCR – We can convert text based document images into text that can be edited by a word – processing software, enrich our presentations and documents by adding images, Convert hard-copy images or documents into a fax format for faxing or for record purpose, add scanned images to our e-mail to enrich the content.

Type of scanners: Flatbed Scanner, Sheet fed, Handheld, Card scan.

Flatbed Scanner

The flatbed scanner as shown in the illustration is one of the most commonly used and most recommended scanners. This scanner allows the user to place a full piece of paper, book,
Magazine, photo or any other object onto the bed of the scanner and have the capability to scan that object.

Flatbed scanner

A sheet containing text can be scanned using the scanner and saved as an image file. There is software to convert the image file once again into a text file.

Sheet fed scanner

This scanner allows us to scan pieces of paper. The sheet fed scanner is a less expensive solution when compared to the flatbed scanner.

Handheld Scanner

The handheld scanner allows the user to drag over select sections of pages, books, magazines, and other objects scanning only sections. However it can be tedious to drag the handheld correctly which can cause distortion in the image being scanned.

Hand held scanner

Cards scan Scanner
This scanner is mainly used to scan visiting cards for creating data base of the addresses.

d) Punched cards
Punched cards are still in use as medium for recording data and instructions in the form of punched holes to denote and then they are sequentially read by the card Reader. The card Reader sends the data and instructions to the CPU to process them. The punched cards used for data processing are made generally of 80 columns and 12 rows. Today 96 columns cards are available. In these cards a hole in punched to represent the binary l. The absence of a hole represents binary 0. If a card is punched wrongly, it cannot be corrected. In addition, the punched cards are not reusable, i.e., cannot be used for any other data. Many numbers of cards are required for the computer programs. Such a collection of cards is called a deck. Each card has the left top corner cut to identify the arrangement of the cards is correct or not. The cards are read by a Unit called a card Reader. The punched cards are placed in the Read Hopper after verification. On receiving the command from the control unit the device moves the cards one by one over two sub-devices. One of which sense the punched holes (0s and 1s) and transcribes the pulses to the CPU. Then the output is given as per user specification.

Advantages
1. It is very easy to read data on the cards
2. The cards are less expensive than other storage media.
3. It is much simple to operate.
4. After inserting a card, if an error is detected, the whole system stops functioning.

Disadvantages
1. Punched cards are bulky when put together, so they require large space to store them.
2. The cards are easily damaged and perishable.
3. Transfer of data is relatively very slow.
4. An incorrectly punched card cannot be corrected, it must be

replaced.

5. Unit Record machines require manual intervention at every stage.
6. Data is not processed in ordinary language. It has to be translated into something we can understand.

e) Paper Tapes

The punched paper tape is a continuous strip of a paper about one inch wide and up to 300 meters long. The characters are recorded on tape, which may be 5 or 8 as per the design of the tape. These punched positions are called as channels. It is the oldest media, of input and output media. Here also, a hole represents 1 and its absence represents 0. Data from the tape is read through a Tape Recorder per second. The tape comes in various forms namely, Oil paper, dry paper, metalized paper and laminated paper.

Advantages

1. Compared to the punched card, it is more compact and economic on storage.
2. It is less in weight and easy for mailing etc.

Disadvantages

1. Since the roll is so long, correcting or inserting data can be very tedious process and time consuming.
2. The life of the paper tape is short. This makes it inconvenient for storing over a long period. It is not durable.
3. Moreover, it is sequential data processing medium.

f) Magnetic Tape

Because of the problems faced in the paper media, magnetic substances have come. First among these was the magnetic tape. This is also a sequential media for normally between 1.252cms wide and up to 900 meters long. It is made of plastic with a metallic magnetic oxide coating on one side. Generally, data is recorded on either a 7 parallel-rack-tape or on a 9 parallel track-tape. Writing on and reading from the tape is done with the assistance of READ/WRITE head. The number of characters per inch length of tape stored is called the 'density' of the tape. This varies from 550 to 1600 or even 16K. The 9 Track tapes have the higher densities. Then comparing with the punched card and punched tape, the magnetic tape has

certain advantages and disadvantages.

Advantages

1. Data are stored very compactly.
2. It is very easy to handle the Magnetic Tape than the Deck of Cards.
3. The Magnetic tape costs less than the cards.
4. It requires less storage space for data and therefore has a large capacity.
5. It is reusable i.e., the old data can be wiped out and fresh information could be recorded on it.
6. The speed of transferring the data is very high comparing to paper devices.

Disadvantages

1. In magnetic tapes, the data has to be accessed sequentially. This makes the retrieval of data slow.
2. The punched cards can be read visually, whereas to read the magnetic tape a machine is needed.
3. The tape is subject to the unusual wear and tear of time.
4. Data will be erased if the tape is exposed or placed nearby any Magnetic field or high voltage circuits.

g. Magnetic Disk

It is yet another step in the evolution of Input/output devices. The Magnetic Disk has an advantage over the punched cards and Magnetic Tapes i.e., the data stored on a disk can be read randomly while in the magnetic tape, the data are read sequentially. Random access is that the particular record in the file can be detected directly and the access time is saved. In Magnetic disk the record is accessed in a fraction of second i.e., less than 0.01 sec. The disks varying in diameter are generally coated on both sides with magnetic oxide. Each surface of the disk is divided into a number of sectors, called storage segments. The storage segment is a specific portion of a specific side of the disk. A segment can store one or more record of a file, which will vary according to the size of the record. While searching, a particular record can randomly be selected and directly accessed, because, each storage segment is uniquely marked by an address with side number, track number, sector number etc.

h. Joysticks and Trackballs

Joysticks provide an alternative method for feeding the computer visually with interesting data. When you move the joystick, cursor on the screen moves in a corresponding way. A trackball is a plastic sphere mounted in a socket so that it is free to rotate in any direction.

i. Touch Screens

Touch Screens are another favorite "user friendly" method for feeding data into computer. User can command the computer to perform various useful tasks simply by touching specific sectors of the screen with their forefingers. The computer senses the Location of the finger in various ways.

12.3 OUTPUT UNIT

The results of the data processed by the computer are available in electronic signals. The output unit converts these signals into a form which could be easily understood by us. The output is usually given either on the screen by visual display unit/monitor or in a printed form by printers.

a) Monitor (Visual Display Unit or Screen)

The monitor is made up of cathode-ray tube CRT due to which it also called C.R.T terminal. The screen consists of horizontal and vertical sweep circuits similar to T.V. sets. The screen's inside is coated with dots of phosphor called pixel and can be used for games or graphics or displaying the

Results of a calculation done by computer. The more the number of pixel or dots in a screen, the better will be the capability of computer to display an information. This capability is known as resolution. The characters typed with the keyboard are displayed on the screen. We can thus verify whether the programs we enter into computer is correct or not.

Tips for avoiding computer vision syndrome:

Long hours of staring at a computer screen causes dryness and reduces the blinking rate of the eyes. Burning, itchiness and watering of eyes are the

common visible syndromes of computer vision syndrome. Often headache is a direct consequence of the glare emitted by the screen.

- To avoid the syndrome the following measures are to be taken:
- Make sure that the computer screen is not too close to your face.
- Position the screen so that it is either at eye level, or slightly lower.
- Slant the monitor slightly to eliminate reflection or glare.
- Make sure that primary light source (such as windows) is not shining into your face or directly on the monitor.
- Frequently look away from the screen and focus on far away objects.
- Reduce the contrast and brightness of the screen by adjusting the controls on the monitor.

b. Printer

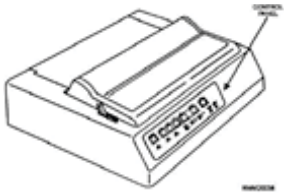
Printer is the most commonly used output device. It is used to prepare permanent documents in human – readable form (hard copy). They are several types of printers that are designed for different types of applications.

Printers are of two types: Impact and Non-impact. Impact printers use the familiar typewriter approach of trouncing a typeface against paper and inked ribbon. Non- impact printers do not hit or impact a ribbon to print. They use thermal, electrostatic, chemical and inkjet technologies. Depending on their speed and approach of printing, printers are also classified as character printers, and page printers.

Types of Printers

1. Dot Matrix Printer

In this printer characters to print are made up of a finite number of dots and so, the print head consists of an array of pins. Characters to be printed are made up of a finite number of dots and so the printer. The character code is decoded by the printer electronics and activates the appropriate pins in the print head. Many dot matrix printers are bi-directional. i.e., they print from left to right as well as from right to left on return. This



enhances the speed of printing. The printing speed is around 300 characters per Dot Matrix Printer second.

2. Line Printer

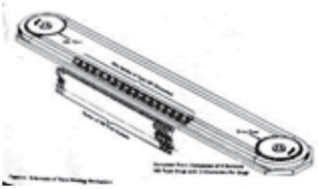
Unlike a dot matrix printer, line printer prints a complete line at a time. Two types of line printers are available.

2. Drum Printer

It consists of cylindrical drum. The characters to be printed are embossed on its surface.

3. Chain Printer

It has a steel band on which the character sets are embossed. Printing speed varies from 150 lines to 2500 lines per minute with 96 to 160 characters on a 15 inch line. Six to eight lines per vertical inch are printed. Usually 64 and 96 character sets are used with English letters.



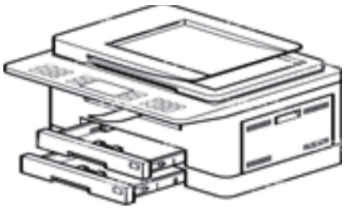
4. Inkjet Printer

Inkjet Printer consists of print heard, which has a number of small holes of nozzles. Individual holes are heated very rapidly by an integrated circuit resistor. When the resistor heats up, the ink near it vaporizes and it's ejected through the nozzle and makes a dot on paper placed near the head. A high – resolution inkjet printer has around 50 nozzles within a height

Of 7mm and can print with a resolution of more than 300 dots per inch. Latest inkjet printers have multimedia heads, one

Color, which allow color printing. The printing speed is around 120 characters per second.

5. Laser Printers



- In laser printer an electronically controlled laser beam traces out the desired character to be printed on a photo conductive drum
- The drum attracts an ink toner on to the exposed areas. This image is transferred to the paper, which comes in contract with the drum.
- Very fast printers print 10,000 lines per minute. These Printers give excellent outputs and can print a variety of font andlow speed laser printers, which can print 4 to 16 pages per minute, are now very popular.

12.4 CHAPTER SUMMATION

1. The input unit is used for entering the data and instruction into the computer for performing computation of the data.
2. Keyboard and Mouse are the important input devices used in our offices. Light pen, Joy stick, Track ball, Touch pad, Scanner and Pointing stick are some of the other Input Devices.
3. The results of the data processed by the computer are available in electronic signals. The output unit converts these signals into a form which could be easily understood by us.
4. Monitor (Visual Display Unit or Screen) and printers are the most frequently used output devices.

12.5 DISCUSSIONS

1) Explain in detail about the various types of Input devices.
2) Write short notes on output devices.
3) Explain in detail the various types of printers.

12.6 CHAPTER PROGRESS

1. A.

I). Key Board
ii). Mouse
iii). Scanner

iv). Punched cards
v). Paper Tapes
vi). Magnetic Tape
vii). Magnetic Disk
viii). Joysticks and Trackballs
ix). Touch Screens

B.

a). Monitor - Output
b). Mouse - Input
c). Keyboard - Input
d). Printer - Output
e). Scanner - Input

CHAPTER THIRTEEN

STORAGE UNIT AND CPU

13.0 Aims and Objectives
13.1 Introduction
13.2 Storage Unit
13.3 Central Processing Unit (CPU)
13.4 Chapter Summation
13.5 Discussions
13.6 Chapter Progress

13.0 AIMS AND OBJECTIVES

After studying this lesson, you will be able to understand:

1. Types of storage devices available and its uses.
2. Central processing unit and its functions.

13.1 INTRODUCTION

The purpose of the storage unit of the computer is to store the data entered before processing and also to store the results after processing. The Central Processing Unit [CPU] is the brain of any computer system. In a computer system all major calculations and comparisons are made inside the CPU. The CPU is also responsible for activating and controlling the operations of other units of a computer system.

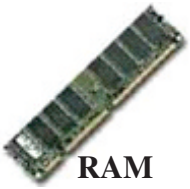
13.2 STORAGE UNIT

There are two types of storage devices.

a. Primary storage device
b. Secondary Storage device.

a. PRIMARY STORAGE DEVICE OR RANDOM ACCESS MEMORY [RAM]

Primary storage is usually referred to as Random Access Memory [RAM] because it is possible to randomly select and use any location of this memory to directly store and retrieve data and instructions. It is also referred to as read/write memory because information can be 'read' from a RAM chip also is 'written' into it.



RAM

The Random Access Memory requires some times for accessing data,
and it is considered to be the fastest memory. Each bit in a RAM stores Information by means of electric charge, where the presence of an electric charge indicates '1' and the absence of a '0'. RAM is called temporary storage, because data persists until the machine is on.

ROM

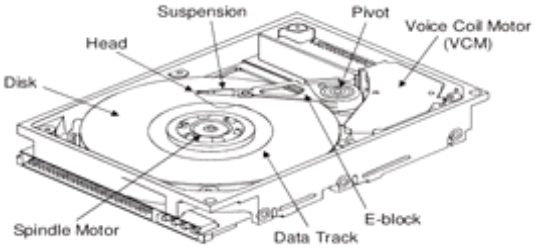
A Read Only Memory [ROM] is one in which information is permanently stored. The information from the memory can only be read and it is not possible to write fresh information into it. This is the reason why it is called ROM. When the power supply is switched off, the information stored inside ROM is not lost as it is in the case of a RAM chip. ROMs are mainly used by computer manufacturers for storing the micro programs so that they cannot be modified by the users.

b. SECONDARY STORAGE DEVICES

This section of the memory is also referred to as backup storage because it is used to store large volume of data on a permanent basis which can be partially be transferred to the primary storage as at when required for processing.

The storage capacity of the primary storage of today's computers is not sufficient to store the large volume of time handled by most data processing centers. As a result, additional memory, called auxiliary memory or secondary storage, is used with most computer systems. Hard Disk, Floppy Disk, Tape and Compact Disc are the main secondary storage

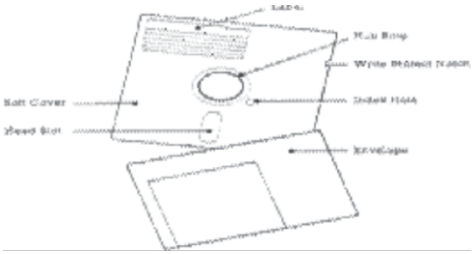
devices.



I). Hard Disk

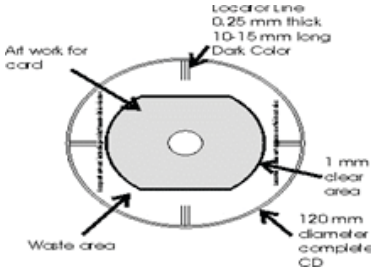
The hard disk used in the PC is permanently fixed, hard disks with storage capacities of 8 GB, 10GB, 20GB, 40GB, are quite common, the CPU can use the hard disk to load programs and data as well as to store data We should operate the PC within a dust-free and cool room (Preferably air-conditioned) to prevent hard disk crash.

ii). Floppy Disk



Floppy disk is flexible circular disk of diameter 3 inches made of plastic coated with a magnetic material. This is housed in a square plastic jacket. The floppy disk can store 1.4 Mbytes of data. Data recorded on a floppy disk is read and stored in a computer's memory by a device called a floppy disk drive [FDD]. A floppy disk is inserted in a slot of the FDD. Some of the floppies have limited life time. The floppies have to be recycled periodically to keep them alive. A frequently recycled floppy. [i.e. used] will have a life time of 3 to 4 years to do recycling take out old floppies occasionally and try to read them once, at least the directory.

iii). Compact Disk



CD-ROM [Compact Read Only Memory] uses a laser beam to record and read data along spiral tracks on a 51/4" disk. A disk can store around 650/00MB of information. CD-ROMs are normally used

to store data as back up. Using a CD Writer, lot of information can be written on CD-ROM and stored for future reference.

iv). Tape Drives

Even though tape drives are one of the oldest of storage technologies, they can still hold the most data on a single cartridge. A computer tape drive works similar to a tape recorder or a VCR. A plastic tape ribbon is coated with magnetic particles which are polarized by a magnetic field generated by the read/write head.

Since tape is a sequential, and not a random- access media, a tape drive has to wind through a tape to locate a specific bit of data. This makes accessing data slow so tape is mainly used for system backups and regular archiving of files and records.

Tape dives allow users to backup large amounts of data. Tape drives are capable of backing up a couple hundred megabytes to several gigabytes of information without having to spend large sums of money on disks.

iv). DLT [Digital Linear Tape]

DLT drives are a robust and durable medium. The DLT segments the tape into parallel horizontal tracks and records data by streaming the tape across a single stationary head. Released in 1991 DLT drives are very reliable, high-speed, and high-capacity making the DLT drives an excellent use for Network backups.

v). DAT [Digital Audio Tape]

The popular choice for tape drives is DAT. This format is best known for digital audio recording although DAT drives can't play DAT audio. These drives use a recording technique called helical scanning which is used in VCRs. The 4mm tape is wrapped round a spinning read/write head that records data in overlapping diagonal tracks. These overlapping tracks allow for high data density and faster data transfer speeds. There are a few DAT standards but the most common is Digital Data Storage [DDS]. DAT tapes can hold 2GB

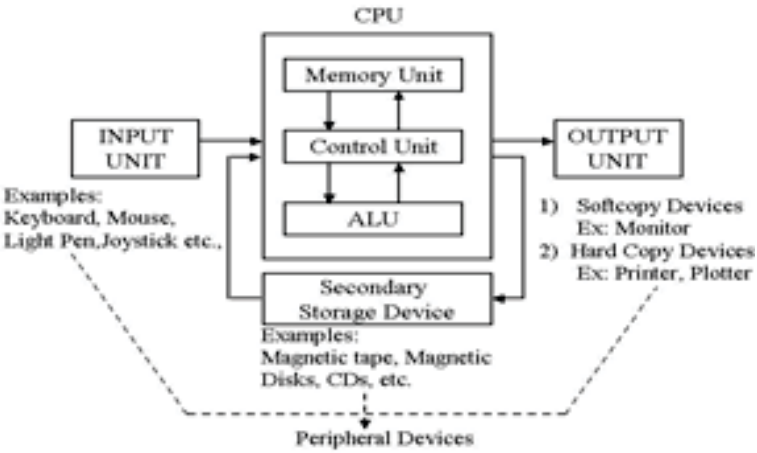
to 40GB [DDS-4] of compressed data.

vi). Micro Vault USB Storage Media

Micro Vault media plugs directly into the computer's USB port – and acts just like another drive. It is small light, Shock-proof and moisture – proof. This nifty flash memory storage device is compact and durable enough to carry in any pocket. The device is recognized automatically when we connect it to the computer. By connecting it via USB, the files can be transferred by dragging and dropping. There are no cables or adaptors needed no power cord and no driver software to install. It's compatible with both Macintosh and Windows operating systems, and Micro Vault even comes with software that password protects the contents of the device. They are perfect for sharing PowerPoint presentations, digital photos, MPEG video and MP3s, transporting files between work and home, or sharing files with friends and colleagues.

13.3 CENTRAL PROCESSING UNIT [CPU]

The Central Processing Unit [CPU] is the brain of any computer system. In a computer system all major calculations and comparisons are made inside

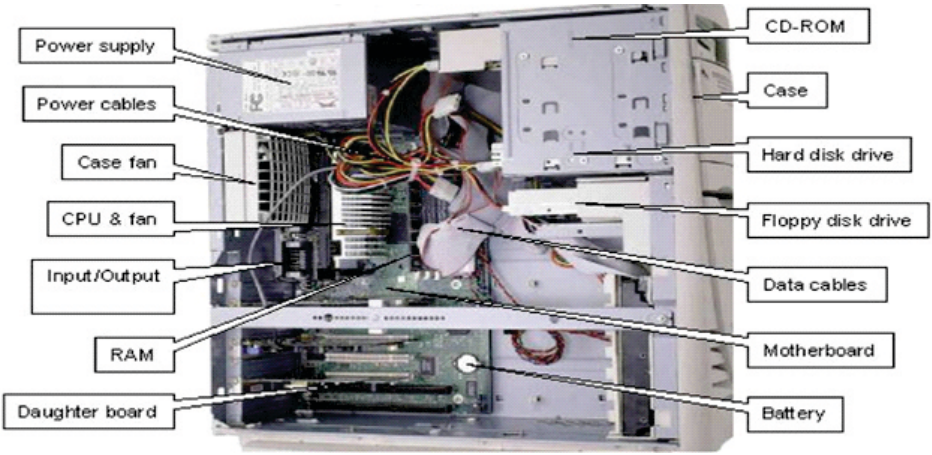


the CPU. The CPU is also responsible for activating and controlling the operations of other units of a computer system.

The control unit and the arithmetic logic unit of a computer system are jointly known as the Central Processing Unit. While the control unit takes care of the flow of data from input unit to storage unit and the flow of final results to the output unit, the arithmetic logic unit is the place where the actual execution of instructions taking place during the processing operation.

The Central processing Unit consists of the following main components

Switched Mode Power Supply [SMPS] - for converting the current voltage, Mother Board [ROM], Arithmetic Logic Unit [ALU], Control Unit [Ram],Hard Disk – Storage unit, Floppy Disk – storage Unit, CD ROM – Storage Unit.



13.4 CHAPTER SUMMATION

1. There are two types of storage devices: primary and secondary storage devices.
2. Primary memory is used to directly store and retrieve data and

instructions. It is also known as temporary storage device.

3. Secondary memory also known as backup storage as it is used to store large volume of data on a permanent basis which can be partially transferred to the primary storage as and when required for processing.

13.5 DISCUSSIONS

1) Write short notes on Primary Storage Devices and Secondary Storage Devices.
2) Write some short notes on Motherboard and list some essential component on it.

13.6 CHAPTER PROGRESS

i). Floppy Disk
ii). Compact Disk
iii). Tape Drives
iv). DAT [Digital Audio Tape]
v). Micro Vault USB Storage Media

CHAPTER FOURTEEN

SOFTWARE

14.0 Aims and Objectives
14.1 Introduction
14.2 Categories of Software
14.3 System Software
14.4 Application Software
14.5 Chapter Summation
14.6 Discussions
14.7 Chapter Progress

14.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. Software and it's types
2. System software which manages the hardware components of the computer.
3. Application software which is useful for accomplishing a particular task.

14.1 INTRODUCTION

The computer being a machine cannot perform on its own. It needs to be instructed to perform even a simple task like adding two numbers. Computers work on a set of instructions called computer software (programs), which clearly specify the ways to carry out a task.

Software can be categorized as **system software and application software**. System software is a generic term for referring to any computer program whose purpose is to help the user to run the computer system, whereas application software is designed to assist the user with a particular process, which may be related to productivity, creativity, and/or communication.

14.2 CATEGORIES OF SOFTWARE

14.2.1 SYSTEM SOFTWARE

System software consists of several programs, which are directly responsible for controlling, integrating, and managing the individual hardware components of a computer system. You must have noticed that a new computer system is always accompanied by some software, either stored in a floppy or CD, which is supplied by the manufacturer. This software manages and supports the computer system and its information processing activities.

System software is more transparent and less noticed by the users, they usually interact with the hardware or the applications this software provides a programming environment in which programmers can create applications to accommodate their needs. This environment provides functions that are not available at the hardware level and performs the tasks related to the execution of an application program. Hence, system software acts as an interface between the hardware of the computer and the software application.

In simple terms, system software makes the computer functional. They provide basic functionality like file management, visual display, and keyboard input are used by application software to accomplish these functions. Some examples of system software are:

1. Operating system
2. Device drivers
3. Language translators
4. System utilities.

1. Operating System

It is the first layer of software loaded into computer memory when it starts up. As the first software layer, all other software that gets loaded after it depends on it for various common core services. These common core services include disk access, memory management, takes scheduling, and user interfacing. In addition the operating system ensures that different programs executing at the same time do not interfere with each other. It provides a software platform on top of which other programs can run. In simple words, the operating system organizes and controls the hardware.

Examples of operating systems are Windows XP, UNIX, and Linux. The basic functions of operating systems are:

a) **Process Management:** It handles the creation, deletion, suspension, resumption, and synchronization of process.

b) **Memory Management:** It handles allocation and de-allocation of memory space as required by various programs.

c) **File Management:** It is responsible for creation and deletion of files and directories. It also organizes, stores, retrieves, names, and protects all the files.

d) **Device Management:** It manages all the devices of the computer system such as printers and modems. If any device fails, it detects the device failure and notifies the same to the user.

e) **Security Management:** Protects system resources and information against destruction and unauthorized use.

f) **User interface:** Provides the interface between the user and the hardware.

2. Device Drivers

Device drivers are system programs, which are responsible for proper functioning of devices. Every device, whether it is a printer, monitor, mouse or keyboard, has a driver program associated with it for its proper functioning. Whenever a new device is added to the computer system, a new device driver must be installed before the device is used. A device driver is not an independent program; it assists and is assisted by the operating system for the proper functioning of the device.

3. Language translators

Computers only understand a language consisting of 0s and 1s called machine language. To ease the burden of programming entirely in 0s and 1s, special programming languages called high-level programming languages were developed that resembled natural languages like English

Language translators help in converting programming languages into machine language. To be precise, they convert programming statements into the 0s and 1s that the computer is able to process.

Depending on the programming language used, language translators are divided into three major categories: compilers, interpreter, and assembler.

a) Compiler

The programs written in any high-level programming language (C or Pascal) needs to be converted into machine language. This is achieved by using a complier.

b) Interpreter

An interpreter analyses and executes the source code in line-by-line manner, without looking at the entire program. In other words, an interpreter translates a statement in a program and executes the statement immediately, before translating the next source language statement.

c) Assembler

Compared to all the types of programming languages, assembly language is closest to the machine code. It is fundamentally a symbolic representation of machine code. The assembly language program must be translated into machine code by a separate program called an assembler. The assembler program recognizes the character strings that make up the symbolic names of the various machine operations, and substitutes the required machine code for each instruction. In short, an assembler converts the assembly codes into machine codes, making the assembly program ready for execution.

Typical software generally comprises millions of lines of programming statements or code. The code is divided into logical groups and stored in different independent modules so that the debugging and maintenance of the code becomes easier. Before execution, different object codes resulting from the independent modules have to be linked together to create an executable program. A linker is a system program that links together several objects modules and libraries to form a single, coherent, program (executable program). The part of the operating system that

brings an executable file residing on disk into memory and executes it is known as loader. Being responsible for tasks like loading, linking and relocation, loader performs the function of a linked program and then immediately schedules the executable for execution without creating an executable file as an output.

4. System Utility

System utility programs perform day-to-day tasks related to the maintenance of the computer system. They are used to support, enhance, and secure existing programs and data in the computer system. They are generally small programs, having specific tasks to perform:

a) File Management

These utilities make it easier to manage data files. Many programs are written to help users to find the files, create and organize directions, copy, move, and remove files.

b) Backup

It may happen that sometime data files are corrupted, or accidentally deleted. In such a case, data backups become very useful. A backup system utility is essential for those organizations, which want to keep their data intact.

c) Data Recovery

It is the process of retrieving deleted or inaccessible data from failed electronic storage media such as computer hard disk drives, removable media, optical devices, and tape cartridges.

d) Virus Protection

Anti-virus programs are essential system utilities for a computer system functioning in a network. They provide the security to the system from viruses that can damage the computer system.

e) Disk Management

Disk management program includes various system software like disk defragmenter, data compressor and disk formatting tools. *De-fragmentation* implies putting rubbles of files in a sequential order onto the

disk which reduces the time to access the file.

f) Firewall

It is commonly used to protect information such as e-mail and data files within a physical building or organization. Essentially, a firewall is designed to protect a computer from unauthorized access, especially via network.

g) Disk Cleanup

To keep a computer running smoothly, regular maintenance is vital. Therefore, one should use the disk cleanup utility, which easily determines which files on hard drive are no longer needed, then delete those files.

14.2.2 APPLICATION SOFTWARE

The most often seen software by a user is the application software. It is used to accomplish specific tasks rather than just managing a computer system. For a user, the computer system has no specific use without application software. Application software may consist of a single program, such as Microsoft's Note pad (for writing and editing simple text). It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as database management software. Application software may also include a larger collection of related but independent programs and packages (a software suite), which have a common user interface or shared data format, such as Microsoft Office suite.

Application software is dependent on system software. A system software (like operating system) acts as an interface between the user and the computer hardware, while application software performs specific tasks. Applications are pieces of software that perform tasks for the user besides helping the computer operate, which is the tasks of system software. Applications software is controlled by system software, which manages hardware devices and performs background tasks for them. The distinction between the two is important. Without system software, the computer will not run, and without application software, the computer, no matter how powerful, will not be supportive in meeting user requirements. Think of it this way applications apply the computer's thinking power to

business tasks such as tracking the general ledger or billing your customers.

Application software ranges from games, calculators, and word processors (document creating programs), to programs that "paint" images on screen (image editors). Applications represent real world tasks. They can be easily divided by looking at exactly what function they serve. Some of the most commonly used application software is discussed below:

1. Word processor

A word processor is software used to compose, format, edit, and print electronic documents. Word processing is one of the earliest applications for office productivity and the personal computer. It involves not only typing, but also checking the spelling and grammar of the text and arranging it correctly on the page. A variety of different typefaces is available for variety of effects. It is possible to include pictures, graphs, charts and many other things within the text of the document. It also allows for changes in margins, fonts, and color. Nowadays, virtually all personal computers are equipped with a word processing program, which has the same function as a typewriter for writing letters, reports or other documents, and printing. Examples of some well-known word processors are Microsoft Word and Word Perfect.

2. Spreadsheets

One of the first commercial uses of computers was in processing payroll and other financial records, so the programs were designed to generate reports in the standard "spreadsheet" format bookkeepers and accountants used. A spreadsheet application is a rectangular grid, which allows text, numbers, and complex functions to be entered into a matrix of thousands of individual cells. The spreadsheet provides sheets containing cells each of which may contain text and / or numbers. Cells may also contain equations that calculate results from data placed in other cells or series of cells. A simple example might be a column of numbers totaled in a single cell containing an equation relating to that column.

Spreadsheet software are used predominantly for accounting and other numerically-based tasks, because financial and mathematical data and

analysis are often managed in a tabular style, with columns of financial figures being manipulated and then influencing other data computations. Microsoft Excel and Lotus 1-2-3 are examples of spreadsheet applications.

3. Image Editors

Image editor programs are designed specifically for capturing, creating, editing, and manipulating images. These graphics programs provide a variety of special features for creating and altering images. In addition to offering a host of filters and image transformation algorithms, some image editors also enable the user to create and intersect layers. Most graphic programs have the ability to import and export one or more graphic file formats. These computer programs enable the user to adjust an image to improve its appearance. With image editing software, one can darken or lighten an image, rotate it, adjust its contrast, crop out extraneous detail, and much more. Examples of these programs are Adobe Photoshop, Adobe Illustrator and CorelDraw.

4. Database management systems

Database management software is a collection of computer programs that allow storage, modification, and extraction of information from a database in an efficient manner. It supports the structuring of the database in a standard format and provides tools for data input, verification, storage, retrieval, query, and manipulation. When such software is used, information systems can be changed much more easily as the organization's information requirements change. New categories of data can be added to the database without disrupting the existing system. It also controls the security and integrity of the database from unauthorized access. FoxPro and Oracle are database management systems.

5. Presentation applications

A presentation is a means of assessment, which requires presentation providers to present their work orally in the presence of an audience. It combines both visual and verbal elements. Presentation software allows the user to create presentations by producing slides or handouts for presentation of projects. Essentially, such computer programs allow users to create a variety of visually appealing electronic slides for presentation. Microsoft PowerPoint is one of the most famous presentation applications.

6. Desktop publishing software

The term desktop publishing is usually used to describe the creations of printed documents using a desktop computer. It is a technique of using a personal computer to design images and pages, and assemble type and graphics, then using a laser printer or image-setter to output the assembled pages onto paper, film, or printing plate. This software's are used for creating magazines, books, newsletters, and so on. Such software assist in creating sophisticated documents including complicated page designs, detailed illustrations, and camera-ready types faces. Quark Express and Adobe PageMaker are desktop publishing software.

14.5 CHAPTER SUMMATION

1. Software is divided into two categories: System software and Application software.
2. System software is used to integrate, control and manage all the hardware components of the computer system. Examples of system software include Operating system, Device drivers, Language translators, System utilities.
3. Application software is used to perform specific tasks of a computer system. Application software is dependent on system software for its functioning.

14.6 DISCUSSIONS

1) Explain in detail the various categories of software.
2) Write short notes of the basic functions of Operating System.
3) What are language translators? Explain.
4) State and explain the functions of system utility software.
5) What is application software? Explain the most commonly used application software.

14.7 CHAPTER PROGRESS

Word processor is software used to compose, format, edit, and print electronic documents.

CHAPTER FIFTEEN

PROGRAMMING LANGUAGES

15.0 Aims and Objectives
15.1 Introduction
15.2 Programming Languages
15.2.1 Machine Language
15.2.2 Assembly Language
15.2.3 High Level Language
15.3 Chapter Summation
15.4 Discussions
15.5 Chapter Progress

15.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. Machine language- its advantages and disadvantages.
2. Assembly language- its advantages and disadvantages.
3. High level language- its advantages and disadvantages.

15.1 INTRODUCTION

Computers are machines. Unfortunately they cannot understand natural languages, such as French, English, Swahili, and Hispanic etc. that human beings speak and understand. Therefore, to give instructions to computers, different languages have been developed. These languages are called computer languages. To get a particular work done by computers, programmers write instructions using these computer languages. Each computer language has its own vocabulary of a natural language that we speak. Each natural language has its rules and grammar. Similarly, each computer language too has its set of rules that are called as syntax. As computers are not intelligent, we have to use the exact syntax rules of the computer language whenever we write any computer program. Otherwise, the computer will not be able to understand our instructions.

Over the last few decades, several computer languages have being developed. Different computer languages are suitable for different applications. For example, COBOL (Common business oriented Language) may be more suitable for business applications, whereas FORTRAN (Formula Translation) may be more suitable for scientific or engineering applications. We can classify all computer languages into three categories.

15.2 PROGRAMMING LANGUAGES

Computer languages are classified into three categories:

1. Machine language
2. Assembly language:
3. High level languages:

15.2.1 MACHINE LANGUAGE

The form in which information is denoted or represented by a combination of "1" and "0"s is called machine language. Programs and data are ultimately represented in machine language in memory and other hardware of the computer.

To start with, computer programmers used machine language for programming. It was tedious since each operation that the computer has to perform is denoted by a particular combination of"1" s and"0"s. Also each computer had its own machine language code. One has to remember all these codes to write a program.

While machine language had the drawbacks mentioned above, it was very efficient in using computer circuits. There was no necessity for software to convert since we can directly represent the machine language in the computer circuits without the necessity of conversion.

First Programmer

Lady Lovelace Ada Augusta (officially the first programmer) suggested binary numbers for computer storage instead of decimals. A British mathematician, Alan Mathison Turing, was the first person to recognize that programming in machine language is less time consuming. In 1952,

John von Neuman proposed to have new programs loaded from a magnetic tape to Read. With differences in magnetic polarities, it can mean either ON or OFF States.

Advantages of Machine Language

Even though machine languages are not a human friendly language, it offers following advantages.

a) Translation Free

Machine language is the only language that computers can directly execute without the need for conversion. Even an application using high-level languages, has to be converted into machine-readable form so that the computer can understand the instructions.

b) High Speed

Since no conversion is needed, the applications developed using machine language is extremely fast. It is usually used for complex applications such as space control system, nuclear reactors, and chemical processing.

Disadvantages of Machine Language

There are many disadvantages in using machine language to develop programs. Some of these are;

a) Machine Dependent

Every computer type differs from the other, based on its architecture. Hence, an application developed for a particular type of computer may not run on the other type of computer. This proves costly as well as difficult for the organizations.

b) Complex Language

Machine language is very difficult to read and write. Since all the data and instructions must be converted to binary code, it is almost impossible to remember the instructions. A programmer must specify each operation, and the specific locations for each piece of data and instructions to be stored. It means that a programmer practically needs to be hardware expert to have proper control over the machine language.

c) Error Prone

Since the programmer has to remember all the opcodes (operation codes) and the Memory location, machine language is bound to be error prone. It requires a super human effort to keep track of the logic of a problem and, therefore, results in frequent programming errors.

d) Tedious

Machine language poses real problems while modifying and correcting a program. Sometimes the programming becomes too complex to modify and the programmer has to rewrite the entire logic again. Therefore, it is very tedious and time-consuming, and since time is a precious commodity, programming using the machine language tends to be costly. Due to its overwhelming limitations, machine language is rarely used nowadays.

14.2.1 ASSEMBLY LANGUAGE

As computer field advanced, computer scientists felt the necessity of making computer programming easier. They invented computer languages that are easy to remember and use. These languages called assembly language uses mnemonic codes(a **code** that can be remembered comparatively easily and that aids its user in recalling the information it represents).

For Example: For adding two quantities X and Y, You may code as follows.

ADD X Y

ADD is called operation code that tells the computer what operation it has to perform. X and Y are called operation addresses. These refer to the memory addresses where the quantities you want to add are stored. X refers to the location of first quantity and Y the second quantity. These are called symbolic address, since they do not refer to any fixed address. Software called assembler translates this assembly language program into machine language program which you can load into computer memory and execute.

When the program is loaded into memory for execution the symbolic addresses are automatically converted into actual physical addresses of operands involved in an instruction.

Assembly language offers the following advantages

a) The assembly language uses mnemonic ( ) codes, for programming. So it is easier for the programmer to use assembly language than machine language for programming.

b) The assemblers, in addition to translating the assembler language program into machine language, list the program statements (called source code) and also the syntax errors that the programmer committed.

Assembly language has certain disadvantages too

a) One has to spend considerable time in writing the assembly language program.

b) An assembly language program has to be converted into machine language program using assembly.

c) While it is easier to use than the machine language one still has to remember the operation codes for various operations.

15.2.3 HIGH LEVEL LANGUAGES:

During 1960s computers started to gain popularity and it became necessary to develop languages that were more like natural languages such as English so that a common user could use the computer efficiently. Since assembly language required deep knowledge of computer architecture, it demanded programming as well as hardware skills to use computers. Due to computer's widespread usage, early 1960s saw the emergence of the third generations programming languages (3GL). Languages such as COBOL, FORTRAN, BASIC, and C are examples of 3GLs and are considered high-level languages.

High level languages are similar to English language. Programs written using these languages can be machine independent. A single high-level statement can substitute several instructions in machine or assembly language. Unlike assembly and machine programs, high-level programs may be used with different types of computers with little or no modification, thus reducing the re-programming time.

In high-level language, programs are written in a sequence of statements to solve a problem. For example, the following BASIC code snippet will

calculate the sum of two numbers

```
LET X     =     10
LET  Y    =     20
LET SUM   =     X + Y        PRINT SUM
```

The first two statements store 10 in variable X (memory locations name) and 20 in variable, Y, respectively. The third statement again creates a variable named SUM, which will store the summation of X and Y value. Finally, the output is printed, that is, the value stored in SUM is printed on the screen.

Translating High-level Language to machine language

Since computers understand only machine language, it is necessary to convert the high level language programs into machine language codes. This is achieved by using language translators or language processors, generally known as compilers, interpreters or other routines that accepts statements in one language and produces equivalent statements in another language.

a) Compiler

A compiler is a kind of translator that translates a program into another program, known as target language. Usually, the term compiler is used for language translator of high-level language into machine language. The compiler replaces single high-level statement with a series of machine language instruction. A compiler usually resides on a disk or the storage media. When a program is to be compiled, its compiler is loaded into main memory. The compiler stores the entire high-level program, scans it and translates the whole program into an equivalent machine language program. During the translation process, the compiler reads the source program and checks the syntax (grammatical) errors. If there is any error, the compiler generates an error message, which is usually displayed on the screen. In case of errors, the compiler will not create the object code until all the errors are rectified.

Once the program has been compiled, the resulting machine code is saved in an executable file, which can be run on its own at any time. To be precise, once the executable is generated, there is no need for the actual source code file. Anyway, it is worthwhile to keep the source file(s)

because if the source code is modified, it is necessary to recompile the program again to regenerate the executable file containing amendments.

Compilers

Compiler is a program which translates source code written in a particular Programming language into computer-readable machine code that can be directly loaded and executed. For each highlevel language, a separate compiler is required. For example, a compiler for C language cannot translate a program written in FORTRAN. Hence, to execute both language programs, the host computer must have the compilers of both languages.

b) Interpreter

Unlike compilers, an interpreter translates a statement in a program and executes the statement immediately, before translating the next source language statement. When an error is encountered in the program, the execution of the program is halted and an error message is displayed. Similar to compilers, every interpreted language such as BASIC and LISP has its own interpreters.

Advantages of high-level languages

High-level languages (HLL) are useful in developing complex software, as they support complex data structures. It increases the programmer's productivity (the number of lines of code generated per hour). Unlike assembly language, the programmer does not need to learn the instructions set of each computer being worked with. The various advantages of using high-level languages are discussed below:

a) Readability

Since high-level languages are closer to natural languages, they are easier to learn and understand. In addition, a programmer does not need to be aware of computer architecture; even a common man can use it without much difficulty. This is the main reason of HLL's popularity.

b) Machine Independent

High-level language are machine independent in the sense that a program created using HLL can be used on different platforms with very little or no

change at all.

c) Easy Debugging

High-level languages include the support for ideas of abstraction so that programmers can concentrate on finding the solution to the problem rapidly, rather than on low-level details of data representation, which results in fewer errors. Moreover, the compilers and interpreters are designed in such a way that they detect and point out the errors instantaneously.

d) Easier to Maintain

As compared to low-level languages, the programs written in HLL are easy to modify and maintain because HLL programs are easier to understand.

e) Low Development Cost

High-level languages permit faster development of programs. Although a high-level program may not be as efficient as an equivalent low-level program, but the savings in programmer's time generally outweighs the inefficiencies of the application. This is because the cost of writing a program is nearly constant for each line of code, regardless of the language. Thus, a high-level language, where each line of code translates to 10 machine instructions, costs only a fraction as compared to program developed in a low-level language.

f) Easy Documentation:

Since the statements written in HLL are similar to natural languages they are easier to understand as compared to low-level languages.

Disadvantages of high-level languages

The main disadvantages of this language are:

a) Poor Control on Hardware

High-level languages are developed to ease the pressure on programmers so that they do not have to know the intricacies of hardware. As a result, sometimes the applications written in high-level languages cannot completely harness the total power available at hardware level.

b) Less Efficient

The HLL applications are less efficient as far as computation time is concerned. This is because, unlike low-level languages, high-level languages must be created and sent through another processing program known as a complier. This process of translation increases the execution time of an application. Programs written in high-level languages take more time to execute, and require more memory space. Hence, critical applications are generally written in low-level languages.

15.3 CHAPTER SUMMATION

1. In machine language, information is represented in the form of binary numbers '0's and '1's. Due to its disadvantages like machine dependability, complex language are prone to errors, it is not widely used.
2. Due to the disadvantages of machine language, Assembly language came into being. The Assembly language is written in the form of mnemonic codes.
3. High level languages are similar to English language. Programs written using these languages are machine independent. As it is machine independent, translators like compilers and interpreters are available to translate high level language to machine language.

15.4 DISCUSSION

1) Explain the different classification of programming languages.
2) State and explain the advantages of machine language.
3) Write short notes on High Level Programming Languages.
4) Briefly explain the advantages of High Level Languages.

15.5 CHAPTER PROGRESS

1. Advantages of high-level languages:

a. Readability
b. Machine independent
c. Easy Debugging

2. Disadvantages of Machine Language:

i). Translation Free

ii). High Speed
iii). Machine Dependent
iv). Complex Language
v). Error Prone
vi). Tedious

CHAPTER SIXTEEN

PROGRAM DEVELOPMENT

16.0 Aims and Objectives
16.1 Introduction
16.2 Developing a Program
16.2.1 Program Development Cycle (Steps In Developing a Program)
16.2.2 Algorithm
16.2.3 Flowchart
16.3 Chapter Summation
16.4 Discussion
16.5 Chapter Progress

16.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. Steps in development of a program.
2. Algorithm and its properties.
3. Flow chart- its benefits and symbols used in program flowchart.

16.1 INTRODUCTION

The computer has emerged as the most useful machine in recent times. It can perform a variety of tasks like receiving data, processing it, and producing useful results. However, being a machine, the computer cannot perform on its own. A computer needs to be instructed to perform even a simple task like adding two numbers. Computers work on a set of instructions called computer program, which clearly specify the ways to carry out a task. An analogy of this may be thought of as the instructions given by the manager or team leader to its team. The team members follow those instructions and accordingly perform their duties. Similarly, a computer also takes instructions, in the form of computer programs, and carries out the requested task.

Now the questions arises how human beings instruct computers. We, as human beings, use natural languages such as English, Spanish, or French to communicate. Similarly, a user communicates with the computer in a language understood by it. Note that human beings cannot interact directly with the computer using natural languages because thus far we have not developed such computers that can comprehend natural languages. Rather the instructions, provided in the form of computer programs, are developed using computer or programming languages. This chapter will provide some of the most prominent concepts related to computer programming and languages.

16.2 DEVELOPING A PROGRAM

A program consists of a series of instructions that a computer processes to perform the required operation. In addition, it also includes some fixed data, required to perform the instructions, and the process of defining those instructions and data. Thus, in order to design a program, a programmer must determine three basic rudiments:

- ❖ The instructions to be performed and the order in which those instructions are to be performed.
- ❖ The data required to perform those instructions.

To perform a task using a program, a programmer has to consider various inputs of the program along with the process, which is required to convert the input into desired output. Suppose we want to calculate the sum of two numbers, A and B, and store the sum in C, here A and B are the inputs addition is the process, and C is the output of the program.

AB C = A + B C
Input Processing output

Development of a Program

A program is a set of instructions that instructs a computer how to perform a specific task. It is written in a high level language that can be implemented on a number of different processors. A collection of Programs can be compared to a recipe book, where each recipe can be assumed as a program. Every recipe has a list of ingredients (Fixed data)

and a list of instructions detailing exactly what to do with those ingredients. When you follow a recipe, you are actually executing a program.

16.2.1 Program Development Cycle (Steps In Developing a Program)

Before starting the process of writing a program (coding), the programmer has to determine the problem that needs to be solved. There are different approaches to problem solving. Most require breaking the problem into a series of smaller steps, independent of the programming languages. One common technique is to use the program development cycle, with the number of steps they may vary according to the person who has formalized the development. Often the process runs in a loop, for example, as the current process is completed, new demands appear and the development process commences again. Development cycle of a program includes the following phases:

a) Analyze/Define the problem

Firstly, the problem is analyzed precisely and completely. Based on understanding, the developer knows about the scope within which the problem needs to be developed.

b) Task Analysis

After analyzing the problem, the developer needs to develop various solutions to solve the given problem. From these solutions, the optimum solution (by experimenting with all the solutions) is chosen, which can solve the problem comfortably and economically.

c) Developing Algorithm

After selecting the appropriate solution, algorithm is developed to depict the basic logic of the selected solution. An algorithm depicts the solution in logical steps (sequence of instructions). Further, algorithm is represented by flowcharts and pseudo codes. These tools make program logic clear and they eventually help in coding.

d) Testing the Algorithm for Accuracy

Before converting the algorithms into actual code, it should be checked for accuracy. The main purpose of checking algorithm is to identify major

logical errors at an early stage, because logical errors are often difficult to detect and correct at later stages. The testing also ensures that the algorithm is a "true" one and it should work for both normal as well as unusual data.

e) Coding

After meeting all the design considerations, the actual coding of the program takes place in the chosen programming language. Depending upon application domain and available resources, a program can be written by using computer languages of different levels such as machine, assemble or high-level languages.

f) Test and Debug the Program

It is common for the initial program code to contain errors. A program compiler and programmer-designed test data machine tests the code for syntax errors. The results obtained a compared with results calculated manually from this test data. Depending upon the complexity of the program, several rounds of testing may be required.

g) Documentation

Once the program is free from all the errors, it is the duty of the program developers to ensure that the program is supported by suitable documentation. These documents should be supplied to the program users. Documenting a program enables the user to operate the program correctly. It also enables other persons to understand the program clearly so that it may, if necessary, be modified, or corrected by someone other than the original programmer.

h) Implementation

After performing all the above-mentioned steps, the program is installed on the end user's machine. In this stage, users are also provided with all the essential documents so that they can understand how the program works. The implementation can be viewed as the final testing because only after using the program, the user can point out the drawbacks, if any to the developers. Based on the feedback, the programmers can modify or enhance the program.

I) Maintenance and Enhancement

After the program is implemented, it should be properly maintained taking care of the changing requirements of its users and system. The program should be regularly enhanced by adding additional capabilities. This phase is also concerned with detecting and fixing the errors, which were missed in testing phase. Since this step generates user feedback, the programming cycle continues as the program modified or reconstructed to meet the changing needs.

16.2.2 ALGORITHM

Algorithms are one of the most basic tools that are used to develop the problem solving logic. An **algorithm** is defined as a sequence of clear instructions that, when provided with a set of input values produces an output and then terminates. To build an algorithm, the steps must be unambiguous and after a finite number of steps, the solution of the problem is achieved. However, algorithms can have steps that repeat (iterate0 or require decisions logic and comparison) until the task is completed.

Different algorithms may accomplish the same task, with a different set of instructions, in more or less the same time, space, and efforts. For example, two different recipes for preparing tea, one 'add the sugar' while 'boiling the water' and the other 'after boiling the water' produce the same result. However, performing an algorithm correctly does not guarantee a solution, if the algorithm is flawed or not appropriate to the context. For example, preparing the tea algorithm will fail if there are no tea leaves present; even if all the motions of preparing the tea are performed as if the tea leaves were there. We use algorithms in our daily life. For example, to determine the largest number out of three numbers A, B, and C, the following algorithm may be used.

Step 1: Start
Step 2: Read three numbers say A, B, C
Step 3: Find the larger number between A and B and store it in MAX_AB.
Step 4: Find the larger number between MAX_AB and C and store it in MAX.
Step 5: Display MAX
Step 6: Stop

The above-mentioned algorithm terminates after six steps. This explains the feature of finiteness. Once the solution is properly designed, the only job left is to code that logic into a programming language.

Algorithm Properties: Properties of Algorithm are:

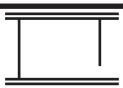
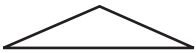
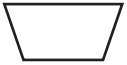
- There must be no ambiguity in any instruction.
- There should not be an uncertainty about which instruction is to be executed next.
- The description of the algorithm must be finite. An algorithm cannot be open-ended.
- The execution of the algorithm should conclude after a finite number of steps.
- The algorithm must be general enough to deal with any contingency.

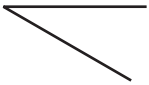
16.2.3 FLOWCHART

A flowchart is a pictorial representation of an algorithm in which the steps are drawn in the form of different shapes of boxes and the logical flow is indicated by interconnecting arrows. The boxes represent operations and the arrows represent the sequence in which the operations are implemented. The primary purpose of the flowchart is to help the programmer in understanding the logic of the program. Therefore, it is always not necessary to include all the required steps in detail. Flowcharts outline the general procedure. Since they provide an alternative, visual way of representing the information flow in a program, program developers often find them very valuable.

Flow charts can be compared within the blueprint of a building. Just as an architect draws a blueprint before starting the construction of a building, a programmer draws a flowchart before writing a computer program. As in the case of the drawing of a blueprint, the flowchart is drawn according to defined rules and using standard flowchart symbols prescribed by American National Standard Institute (ANSI). Some standard symbols that are frequently required for flowcharts are shown:

Table Flowchart symbols

Symbol	Symbol Name	Description
	**Flow Lines**	Flow lines are used to connect symbols. These lines indicate the sequence of steps and the direction of flow.
	Terminal	The symbol is used to represent the Beginning (start), the termination (end) or halt (pause) in the program logic
	Processing	Process symbol is used for representing arithmetic and data movement instructions. It can represent a single step ('add two cups of flour), or an entire sub-process ('make bread') within a larger process.
	**Decision**	Decision symbol denotes a decision (or branch) to be made. The program should continue along one of the two routes (IF/ELSE) This symbol has one entry and two exit paths. The path chosen depends on whether the answer to a question is yes or no.
	Connector	Connector symbol is used to join different flow lines.
	Off-Page Connecter	This symbol is used to indicate the flowchart continues on the next page
	Document	Document is used to represent a paper document produced during the flowchart process.
	Annotation	It is used to provide additional information about another flowchart symbol. The content may be in the form of descriptive comments, remarks or explanatory notes.
	Manual Input	Manual input symbol represents input to be given by a developer / programmer.
	**Manual Operation**	Manual operation symbol shows that the process has to be done by a developer/ programmer.
	Online Storage	This symbol represents the online data storage such as hard disks, magnetic drums, or other storage devices.
	Offline Storage	This symbol represents the offline data storage such as sales on OCR and data on punched cards

	**Communication Link**	Communication link symbol is used to represent data received or to be transmitted from an external system
	Magnetic Disk	This is used to represent data input or output from and to a magnetic disk

Benefits of Flowcharts:
A flowchart helps to clarify how things are currently working and how they could be improved. It also assists in finding the key elements of a process by drawing clear lines between the end of one process and the start of next one.

a) Makes Logic Clear
The main advantage of using a flowchart is to plan a task that provides a pictorial representation of the task, which makes the logic easier to follow. The symbols are connected in such a way that they show the movement (flow) of information through the system visibility. Even less experienced personnel can trace the actions represented by a flowchart, that is, flowcharts are ideal for visualizing fundamental control structures employed in computer programming.

b) Communication
Being a graphical representation of a problem-solving logic, flowcharts are better way of communicating the logic of a system to all concerned. The diagrammatical representation of logic is easier to communicate to all the interested parties as compared to actual program code as the user may not be aware of all the programming techniques and jargons.

c) Effective Analysis
With the help of a flowchart, the problem can be analyzed in an effective way. This is because the analyzing duties of the programmers can be delegated to other persons, who may or may not know the programming techniques, as they have a broad idea about the logic. Being outsiders, they often tend to test and analyze the logic in an unbiased manner.

d) Useful in Coding
The flowcharts act as a guide or blueprint during the analysis and program

development phase. Once the flowcharts are ready, the programmers can plan the coding process effectively as they know where to begin and where to end, making sure that no steps are omitted. As a result, error free programs are developed in high-level languages and that too at a faster rate.

e) Proper Testing and Debugging

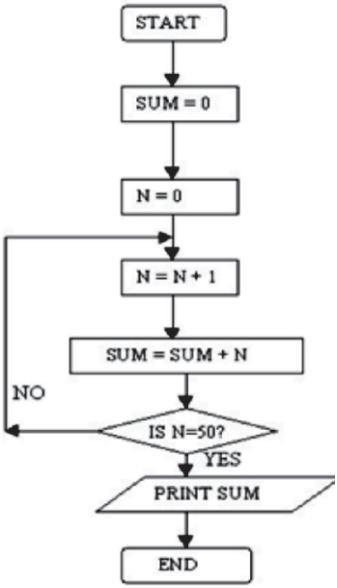
By nature, a flowchart helps in detecting the errors in a program, as the developers known exactly what the logic should do. Developers can test various data for a process so that the program can handle every contingency.

f) Appropriate Documentation

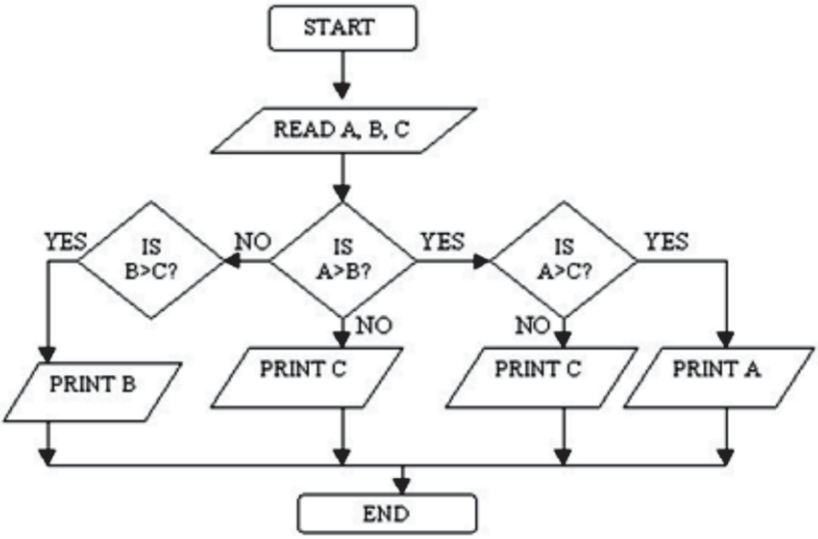
Flowcharts serve as a good program documentation tool. Since normally the programs are developed for novice users, they can take the help of the program documentation to know what the program actually does and how to use the program.

Flowcharting: Examples

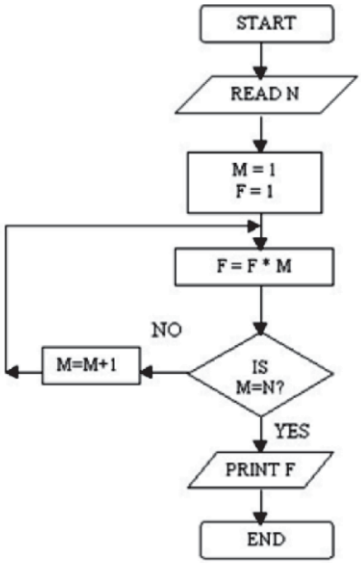
1. Draw a flowchart to find the sum of the first 50 natural numbers.



2. Draw a flowchart to find the largest of three numbers A, B, and C.



3. Draw a flowchart for computing factorial N (N!)
Where N! = 1 ´ 2 ´ 3 ´ …… N.



16.3 CHAPTER SUMMATION

1. Program development involves several steps like: Analyzing/Defining the problem, Task Analysis, Developing Algorithm, Testing the Algorithm for Accuracy, Coding, Test and Debug the Program, Implementation, Maintenance and Enhancement.

2. Algorithm is developed to depict the basic logic of the selected solution. An algorithm depicts the solution in logical steps (sequence of instructions).

3. A flowchart helps to clarify how things are currently working and how they could be improved. It also assists in finding the key elements of a process by drawing clear lines between the end of one process and the start of next one.

4. Flowchart is a pictorial representation of an algorithm in which the steps are drawn in the form of different shapes of boxes and the logical flow is indicated by interconnecting arrows.

16.5 DISCUSSIONS

1) Explain in detail about program development cycle.

(Or)

What are the steps involved in developing a program?

2) What do you mean by an Algorithm? Explain with an example.
3) List out the various properties of algorithm.
4) What do you mean by a Flow-chart?
5) Explain the various symbols used in a flow chart.
6) Define flowchart.
7) What are the steps involved in developing a program?
8) What are the benefits of Flow chart? Explain.

16.6 CHAPTER PROGRESS

1. Steps in developing a program:

i). Analyze/Define the problem
ii). Task Analysis
iii). Developing Algorithm

iv). Testing the Algorithm for Accuracy
v). Coding
vi). Test and Debug the Program:
vii). Documentation
viii). Implementation
ix). Maintenance and Enhancement

CHAPTER SEVENTEEN

OPERATING SYSTEM

17.0 Aims and Objectives
17.1 Introduction
17.2 Operating System
17.2.1 Functions of an Operating System
17.3 Types of Operating System
17.3.1 Dos (Disk Operating System)
17.3.2 Windows Operating System
17.3.3 The UNIX Operating System
17.4 Chapter Summation
17.5 Discussions
17.6 Chapter Progress

17.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. What is an operating system, features and types of operating system and features of operating system?
2. Major functions of operating system.

17.1 INTRODUCTION

Operating System is the first layer of software loaded into computer memory when it starts up. As the first software layer, all other software that gets loaded after it depends on it for various common core services. These common core services include disk access, memory management, time scheduling, and user interfacing. In addition the operating system ensures that different programs executing at the same time do not interfere with each other. It provides a software platform on top of which other programs can run. In simple words, the operating system organizes and controls the hardware. Examples of operating systems are Windows XP, UNIX, and Linux.

17.2 OPERATING SYSTEM

The operating system is a software program that acts as an interface between the user and the computer. It is used to control and manage the hardware components such as keyboard, monitor, printer, scanner etc.

17.2.1 FUNCTIONS OF AN OPERATING SYSTEM

a) Process Management

It handles the creation, deletion, suspension, resumption, and synchronization of process.

b) Memory Management

It handles allocation and de-allocation of memory space as required by various programs.

c) File Management

It is responsible for creation and deletion of files and directories. It also organizes, stores, retrieves, names, and protects all the files.

d) Device Management

It manages all the devices of the computer system such as printers and modems. If any device fails, it detects the device failure and notifies the same to the user.

e) Security Management

Protects system resources and information against destruction and unauthorized use.

f) User interface

Provides the interface between the user and the hardware.

17.3 TYPES OF OPERATING SYSTEM

These are the different types of operating system:

17.3.1 DOS (Disk Operating System)

MS-DOS was the widely used operating system before the introduction of the Windows operating system. Even now the MS-DOS commands are used for carrying out many jobs like copying the files, deleting the files etc.

The DOS is a set of computer programs. The main functions of DOS are to manage files, allocate system resources according to the requirement. It provides essential features to control hardware devices such as keyboard, screen, disk drives, printers, modems etc. Thus, DOS is a medium through which the user and external devices attached to the system communicate the command with the system. DOS translate communication issued by the computer in the format that is understandable by the computer and instruct computer to work accordingly. It also translates the result and any error message in the format for the user to understand.

DOS Commands

We can type all DOS commands in either upper or lower case letters. There are two basic types of DOS commands:

❖ **Internal commands**

These commands, like COPY, DEL, and TYPE, are stored in computers memory. Many DOS commands fall into this category.

❖ **External commands**

This group of commands is stored on the disk. To use them, either insert the DOS floppy disk, or change to the directory on hard disk which contains DOS external commands. Examples of external commands include FORMAT, DISKCOPY, and CHKDSK.

Some commands can take several forms. These separate forms are used by including various parameters with the command. Parameters, which will be discussed with each command, are indicate by a / mark. Here is an example of command with an attached parameter:

C:\>DIR/W
[DOS command DIR is attached with parameter W]
All DOS commands must be activated by pressing the <Enter> key after typing the command.

Features of DOS

❖ Single user system v Machine independence
❖ Program control v Peripheral management

- ❖ Operating with Directories v Managing files v Processing commands v Managing input and output v Data securing
- ❖ Using Batch files v Managing memory v Setting up environment
- ❖ Command processing - DOS shell (a set of commands which is used to create the programs) v Operating with Assembler.

Advantages of DOS

The DOS provides the following advantages:

- ❖ Machine independence v more security v User friendly environment v more useful in commercial applications. v Error finding and recovery is more efficient v Facilities more graphical user interfaces.
- ❖ Easy debugging

17.3.2 WINDOWS OPERATING SYSTEM

Microsoft Windows is the most popular operating system around the world. Even those who are new to computers can use it with a little practice. With the help of Windows, we can operate the computer just by clicking the mouse buttons, Windows95, Windows98, Windows 2000 and Windows XP are the various versions of Windows.

Windows is an operating system. It is the extension of the disk operating system. Windows is system software. It requires DOS to run the application programs. The DOS should be loaded into the memory before the window is executed. After the windows is loaded into the memory the windows environment takes all the device controls. It also takes care of the memory management of the programs run by the windows software.

Types of windows

There are two types of windows. They are

(a) **Application windows** - displays the executable program in graphical user interface mode.

(b) **Document window** - generated by executable or application program.

1. Windows 98

Windows 98 is the upgraded version of Windows 95. It offers bug fixture

and minor enhancements.

Features of Windows

The important features of Windows 98 are as follows:

(a) Graphical User Interface

Windows 98 provides user-friendlier interface to work on. Its improved graphical user interface makes learning and using windows 98 more natural and easier for all types of users. It is more powerful, customizable and efficient.

(b) Type of icons (Small Pictures):

There are three types of icons. They are

i) **Applications icons** - the minimized version of the currently running application programs. It appears at the bottom of the desktop and can be maximized.

ii) **Document icons** - the reduced document windows.

iii) **Program icons** - appear with in program manager and clicking on these icons activate the associated applications and also load the related documents or files.

(c) Start Button

Introduction of START button by windows 98 made life much simpler while there is a need to access multiple programs. It is the gateway of accessing most of the functionality available in the computer loaded with windows 98. Just Click on the start button anytime to start any programs, open or find documents, change windows settings, get Help, manage Files, maintain system, and much more.

(d) Taskbar

The Task bar provides information and access to the entire task that has been currently activated by windows 98. Using this one can keep a track of what all programs have been activated and switched between them.

(e) Windows Explorer

Windows Explorer more or less acts as File Manager for windows 98, but with lots of new features. It is more efficient, faster and user friendly. Using Explorer one can easily browse through all the drives and network

resources available and manage files.

(f) Right Mouse Button

Clicking on the right mouse button activates a pop-up menu in any program so as to help in completing a task efficiently.

(g) Long File Names

As the MS-DOS convention follows, none-of the file used in DOS environment should be more than 8 characters of primary name and optimal secondary name (extension) of three characters. However Windows 98 has broken this barrier. Windows 98 supports long file names maximum of 225 characters. It also allowed space to be used in between file name. This helps to make files and folders (directory/subdirectory) easier to organize and find.

h) Shortcuts

As the name suggests, SHORTCUTS are the shortest way to access programs, files other resources in Windows 98. Instead of going through the structural process of accessing a program, one can create "shortcuts" to access them. It creates links for easy access to file, programs, folders and more.

i) Multitasking

Multitasking allows the user to activate and accomplish more than one task at a time. For example, work on a document file WORD programs, which copies file from other computer available in time on the network. With Windows 98, 32 - bit computing environment, the user can do more than one task a time.

j) Easy Internet Access

Integration of Internet Explorer 4.0 and Active Desktop, which coupled the Internet html hypertext links more tightly to the Windows 98 user interface.

k) Software Compatibility

Windows 98 provides complete backward compatibility. It is easily compatible with other applications developed for MS-DOS and Windows

3.x environment. It also supports latest 32-bit technology. Most of the latest software packages are now built on Windows 98, operating environment.

l) Great Gaming Platform

Windows 98 supports rich graphics, high quality audio and video. Software to take advantage of Intel's Multimedia Extensions (MMX) to the IA - 32 instruction set, which are designed to improve the performance of multimedia applications and games developed for windows 98 that uses MMX technology.

m) Hardware Compatibility

Windows 98 provides greater Hardware compatibility as compared to any other operating environment. It has flexibility of supporting hardware from different vendors.

n) Find utility

Find Utility of windows 98 allows the user to do searches by partial name, last modified date, or full text. In addition we can save, rename or view files from within the result pane.

(o) Help

Windows 98 provides online help to accomplish a task. If the user is not sure how to perform a task, windows 98 Help will provide structured process how to accomplish the task. Simply right-click on any object in the user interface (icon) and he can get relevant description about that object.

(p) Manage more numbers of PC's

Windows 98 can manage up to eight monitors on a- single PC. The user can drag and drop resize and move desktop items such as windows, folders, icons, and applications, from one monitor to the next.

(q) Additional facilities

Windows 98 includes additional enhancement of Windows 95 that includes new backup utilities and disk defragmenter capabilities.

2. Windows NT workstation

Windows NT is a single user; multitasking operating system designed to run on PC workstations and incorporates all latest developments in operating system technology. It was introduced in 1993. It includes the following:

(a) Windows NT workstation
(b) Windows NT server, and
(c) Windows NT enterprise edition

Features

a) Single User Multitasking

The main feature is that even though it is meant for a single user environment, it provides multitasking. For example, a user may use a word processor, a drawing program, a spreadsheet application to produce a document. Without multitasking, simultaneous use of this will not be possible. They must process it one by one; provide alignment making changes will be a tedious process. In a multitasking environment, the user may keep all the applications open, prepare the documentation and make necessary change. All of these are possible with increased speed and memory capacity of microprocessors together with the support for virtual memory.

b) Ability to support all applications

The power of Windows NT comes from its ability to support applications written for other operating systems. This ability is provided through protected subsystems. The protected subsystems are those parts of NT that interact with the end user.

c) Client server computing model

The way in which the executive, the protected subsystems, and the applications structured in NT is by using the client/ server computing model, each server implemented as one or more process. Such process waits for a request from a client for of its services, e.g. Memory services. A client, which may be an applications program or another operating system module, requests a service by sending a message. The message routed through the executive to the appropriate server. The server performs the operation and returns the results or status information by means of another

message, which is routed through the executive back to the client.

Client/server architecture has the following advantages:

(i) It simplifies the base operating system, the NT executive

(ii) It improves reliability. Each server runs on a separate process with its partition of memory, protected from other servers.

(iii) It provides a natural base for distributed computing.

d) Support for Threads

An important feature of Windows NT is its support for threads within process. A thread is a dispatch able unit of work. It is executed sequentially and may be interrupted so that the processor can turn to other threads. A process is a collection of one or more areas and associated system resources. This is similar to a program in execution. By checking an application into multiple threads, the modularity and the timing of application related events could be maintained.

e) Support of Symmetric Multiprocessing (SMP)

In a multiprocessor system, to achieve maximum efficiency and reliability a mode of operation known as symmetric multiprocessing (SMP) is desirable. With SMP, any process or Thread can be assigned to any processor.

f) Windows NT uses concepts of object oriented design

This approach facilitates the sharing of resources and data among processes and the protection of resources and data among processes and the protection of resources from unauthorized access.

Advantages of Windows NT

a) It simplifies the base operating system

b) It improves reliability

c) It provides a natural base of distributed computing

d) Operating-system routines can run on any available processor and different routines can be executed simultaneously on different processors.

e) NT supports the use of multiple threads of execution within a single process.

f) NT processes convenient mechanisms for sharing data and resources between processes.

g) NT provides flexible inter process communication capabilities.

g) Functionality-NT can communicate with many different types of computers.

17.3.3 THE UNIX OPERATING SYSTEM

Like DOS and windows, there's another operating system called UNIX. It arrived earlier than the other two, and stayed back like enough to give us the internet. UNIX is a giant operating system and is way ahead of them in steep power. It has practically everything an operating system should have, and several features which other operating systems never had. Its richness and elegance go beyond the commands and tolls that constitute it, while simplicity permeates the entire system. It runs practically on every hardware and provided motivation to the open source movement.

However, UNIX also makes many demands of the user. It requires a different type of commitment to understand the subject, even when the user is an experienced computer professional. It introduces certain concepts not known to the computing community before, and user numerous symbols whose meaning is anything but clear. It achieves unusual tasks with a few keystrokes, but it takes time to devices a sequence of them for a specific task. Often, it doesn't tell you whether you are right or wrong, and doesn't warn you of the consequences of your actions. That is probably the reason why many people still prefer to stay away from UNIX.

Features of UNIX

UNIX is an operating system; it has all the features an operating system is expected to have. However UNIX also looks at a few things differently and possesses features unique to it. The following section gives a clear idea of the major features of this operating system.

a) UNIX: A Multi user System

From the fundamental point of view, UNIX is a multiprogramming system; it permits multiple programs to run. This can happen in two ways, multiple users can run separate jobs a single user can also run multiple jobs.

b) UNIX: A Multi-tasking System Too

A single user can also run multiple tasks at the same time as UNIX is a multitasking system. It is usual for a user to edit a file, print another one on printer, send email to a friend and browse the World Wide Web - all without leaving any of the application. This kernel is designed to handle a user's multiple needs.

c) The UNIX Toolkit

By one definition, UNIX represents the kernel, but the kernel by itself doesn't do much that can benefit the user. To properly exploit the power of UNIX, you need to use the host of applications that are shipped with every UNIX system. These applications are quite varied in scope. There are general – purpose tools, text manipulation utilities (called filters), compilers and interpreters, networked applications and system administration tools.

d) Pattern Matching

UNIX features very sophisticated pattern matching features. UNIX features elaborate pattern matching schemes that use several characters from the Meta character set. The matching isn't confined to filenames only. Some of the most advanced and useful tools also use a special expression called a regular expression that is framed with characters from the set.

e) Programming Facility

The UNIX shell is also a programming language; it was designed for a programmer, not a casual end user. It has all the necessary ingredients, like control structures, loops and variables, that establish it as a powerful programming language in its own right.

f) Documentation

UNIX documentation is no longer the sore point it once was. Even though it is sometimes uneven at most times the treatment is quite. The principal online help facility available is the man command, which remains the most important reference for commands and their configuration files. One can safely say that there's no feature of UNIX on which a separate textbook is not available.

Apart from the online documentation, there's a vast ocean of UNIX resources available on the internet. There are several newsgroups on UNIX where you can fire your queries in case you are stuck with a problem – be it a problem related to shell programming or a network configuration issue. The FAQ (Frequently Asked Questions) a document that addresses common problems is also widely available on the Net. Then there are numerous articles published in magazines and journals and lecture notes available by universities on their Web sites. UNIX is easily tamed Operating System.

17.4 CHAPTER SUMMATION

1. There are different types of operating system: DOS (Disk Operating System), Windows Operating System, The UNIX Operating System.
2. An operating system performs various functions like Process Management, Memory Management, File Management, Device Management, Security Management, User interface,
3. The main functions of DOS are to manage files, allocate system resources according to the requirement. There are two basic types of DOS commands: Internal commands and External commands
4. Windows is an operating system. It is the extension of the disk operating system. It requires DOS to run the application programs. The DOS should be loaded into the memory before the windows is executed.
5. UNIX is a giant operating system and is way ahead of them in sheer power. It has practically everything an operating system should have, and several features which other operating systems never had.

17.5 DISCUSSIONS

1) List and explain the functions of an Operating System.
2) Write short notes on different types of Operating System.
3) List out the features of DOS.
4) Write short notes on types of DOS commands.
5) Explain in detail about the features of WINDOWS.
6) Explain the various features of WINDOWS NT Work Station.
7) What are the advantages of WINDOWS NT

17.6 CHAPTER PROGRESS

The operating system is a software program that acts as an interface between the user and the computer. It is used to control and manage the hardware components such as keyboard, monitor, printer, scanner etc.

CHAPTER EIGHTEEN

ELECTRONIC COMMERCE

18.0 Aims and Objectives
18.1 Introduction
18.2 Electronic Commerce
18.2.1 Features of E-Commerce
18.2.2 Importance of E-Commerce
18.2.3 Types of Electronic Commerce
18.2.4 E-Commerce Activities
18.3 Chapter Summation
18.4. Discussions
18.5 Chapter Progress

18.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. What is meant by electronic commerce.
2. Features and importance of E-Commerce.
3. Types of E-Commerce and E-Commerce activities.

18.1 INTRODUCTION

The growth of Internet into a global market place attracts more business firms to use this media for commerce. Business firms may use the Internet initially for communication. Websites are set up to provide information about its products and services. Business firms offer corporate information, product information, marketing related services etc.

The Internet has integrated the fragment markets words over though in a modest way. But this interaction is growing rapidly. The most important advantage of the internet for business firms is that it allows reaching customers at a very low cost.

18.2 ELECTRONIC COMMERCE

Electronic commerce is the process of searching, choosing, buying and selling of product or service on the electronic network; it uses the computer and communication networks for promoting products, selling, delivery, collection and delivery service**.**

Electronic Commerce includes:

a) Buying and selling on the internet.
b) Making payments electronically.
c) Business transaction in which there is no physical exchange or physical contact.
d) It is transacting a business over an electronic network without physical contact.

The problems connected with electronic commerce are: a) Identity
b) Authentication
c) Protection of data
d) Confidentiality

These problems can be solved by using:

a) Secure socket layer and hypertext transfer protocol
b) Digital signatures
c) Using public key cryptography
d) Using digital certificates.

In E- commerce, the parties to a transaction interact electronically. They may be separated by long distances physically, yet the electronic network bring them together not only to complete a transaction but also to get after sales support, E-commerce is not just doing transaction over the Internet, it aims at few other things as well like :

- ❖ Web enabling an organization's business so that it can facilitate better customer interaction, handling customer's enquiries, receiving customer's order and payments online.
- ❖ Improving customer service capabilities by allowing customers by providing slow access to its databases containing customer interest information.

- ❖ Use the web to gather customer need information and thus to reducing cycle time by responding to customer needs quickly. It enables the firm in coming out with new available new product information to customers.
- ❖ Raising productivity of all activities in the organization by improving the flow of information in the organization.

18.2.1 FEATURES OF E-COMMERCE

E-Commerce has the following general features:

a) It is a business strategy to cut down costs, while improving quality and increasing the speed of delivery of goods/services.

b) It has ability to sell and purchase products/services/information on computer networks.

c) It is a solution for office automation and quick business transactions.

d) It is a tool to improve intra business functioning like business re-engineering.

e) It is a tool to improve inters business communication through easy and accurate interaction and information interchange.

18.2.2 IMPORTANCE OF E-COMMERCE

E-Commerce becomes inevitable because of the following:

a) Low setup cost

Anybody can easily set up a website. In fact there are many organizations and training institutes who help customers in developing and launching websites. To market a product large retail showrooms are not required, just a web site showing the characteristics of the product including cost details are sufficient.

b) Global Free Market

Nobody can dominate the global market as presence on the internet is easy not only for global giants, but even small organizations can participate actively at low costs and compete with stiff competition.

c) Global Access

Since more than 200 countries are hooked onto the Internet, anybody who can afford a TV and a telephone can fully access the Internet and gain the

information required.

d) Availability of Technology

Since the same technology like web servers, browsers, engines, internet, etc., is used throughout the world therefore business can be easily conducted.

e) Multiple Opportunities

By using E-Commerce multiple activities like selling, renting, purchasing etc. can be performed. In fact a whole variety of transactions can be provided all less than one roof.

f) Others

E-commerce systems are being established for automating and enhancing many aspects of communications, publishing, marketing, sales and customer service such as:

- Customer Research; v Pre-Sales Enquiries; v Information Publishing and Dissemination; v Sales; v Advertising; v Promotions; v Public Relations; v Purchasing; v Transactions; v Funds Transfer; v Production; Delivery; v After-Sales Service;
- Ongoing Relationship Management; and v Customer Support. The benefits of electronic commerce are not just available to large corporations and government departments, and many small to medium businesses are discovering new cost effective opportunities to use Internet-related technology to help their business operations locally and internationally

18.2.3 TYPES OF ELECTRONIC COMMERCE

Based on the parties involved in electronic transactions, the e-commerce can be classified into the following types.

a) Business –to- Business (B2B)
b) Business –to- Consumer (B2C)
c) Consumer –to- Consumer (C2C)

a) Business –to-Business E-Commerce

This is done between business firms. For example, electronic transactions between a manufacturing firm and its supplier firms are B2B transactions.

This segment is the largest and the fastest growing one in electronic, commerce. Here firm use the electronic network for purchasing products, consulting services and paying for them.

b) Business –to- Consumer E-Commerce

Consumers check electronic catalogues to learn about products and compare prices of products sold. They purchase products at the firm's website and may pay electronic cash or other means like credit card.

c) Consumer –to- Consumer E-Commerce

Some sites offer consumers to deal directly with each other. Auction sites are examples. At these auction sites consumers can buy and sell products.

Electronic commerce is useful to both producers and consumers as it helps them overcome the traditional barriers of distance from markets and lack of information about market opportunities. Producers and traders no longer need to maintain physical establishments requiring large capital outlays. Virtual shops and contact points on the Internet may enable storage close to the production site and distribution can be made directly to the consumer. Increased advertising possibilities worldwide may help small and medium industries and businesses that traditionally find it difficult to reach the consumer abroad. E- Commerce may also enable such firms to eliminate middlemen while trying to sell their products abroad.

18.2.4 E-COMMERCE ACTIVITIES

Business firms use the internet platform for communication and commerce. The e- commerce activities can be discussed as follows:

a) Direct marketing and selling

Business firms set up websites for direct marketing and selling. Direct selling was one of the earliest forms of e-commerce. For example, Amazon.com, Barnes and noble and Dell computers engaged in direct selling. Gradually firm moved on to one or more complex operations on the web.

b) Value chain integration

E- Commerce does not tolerate any kind of delay. Delay in inventory

tracking and management can cripple the business. E- Commerce firm use EDI for exchanging transaction data among them so that transactions are automatically processed. Thus suppliers, customers and service providers will use open EDI for integrating their processing systems leading to more efficient operations.

c) Corporate purchasing

Internet provides opportunities for business firms to reduce cost of purchasing. Suppliers keep their electronic catalogs updated. Comparative price information is also available.

Ordering can be electronically done to reduce the laborious paper work in purchasing. Officers can approve purchase orders electronically. The firm can enforce policies; provide greater services to customers and suppliers.

d) Financial and information services

A wide range of financial services are offered on the internet. They include: v online banking v online billing V Online securities transactions v secure information distribution

e) Mobile commerce

Mobile commerce is a part of e-commerce and differs from the latter on the use of mobile telecommunication network in place of telecommunication network. Commerce includes only transactions with a monetary value and it excludes short message services. One condition essential for the success of mobile commerce is large user base of mobile phones. Adequate security for mobile transactions is another condition for its adoption in a big way.

18.3 CHAPTER SUMMATION

1. Electronic commerce is the process of searching, choosing, buying and selling of product or service on the electronic network.
2. Electronic commerce uses the computer and communication networks for promoting products, selling, and delivery collection and delivery service**.**
3. The e-commerce can be classified into Business –to- Business (B2B), Business –to- Consumer (B2C), Consumer –to- Consumer (C2C).

18.4 DISCUSSIONS

1) List out the features of E-Commerce.
2) Explain in detail the Importance of E-Commerce.
3) Write short notes on the types of E-Commerce.
4) What are the E-Commerce activities? Explain.

1. Types of E-Commerce

I). Business –to-Business E-Commerce

ii). Business –to- Consumer E-Commerce

iii). Consumer –to- Consumer E-Commerce

CHAPTER NINETEEN

EXTRANET AND E-MAIL

19.0 Aims and Objectives
19.1 Introduction
19.2 Extranet
19.2.1 Characteristics of Extranet
19.2.2 Uses of Extranet
19.3 Email
19.3.1 How E-Mail Works?
19.3.2 Infrastructure Requirement for E-Mail
19.3.3 E-Mail Addressing Pattern
19.3.4 E-Mail Messages
19.3.5 Usage of Mails
19.4 Chapter Summation
19.5 Discussions
19.6 Chapter Progress

19.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. Characteristics and uses of Extranet.
2. Relationship between intranets, Extranets and e–commerce.
3. Infrastructure Requirement for E-Mail.
4. Advantages and disadvantages of E-mail.
5. Usage of Mails.

19.1 INTRODUCTION

An Extranet is a private network that uses the internet protocol and the public telecommunication system to securely share part of business information or operations with suppliers, vendors, partners, customers, or other businesses.

Through e-mail, documents are prepared and sent electronically. The recipients need not be present at the other end to send the message. The message gets stored in the electronic mailbox of the addressee. The recipient can open the mailbox whenever he is free and can read or print the message.

19.2 EXTRANET

An Extranet can be viewed as a part of a company's intranet that is extended to users outside the company. It has also been described as a "state of mind" in which the internet is perceived as a way to do business with other companies as well as to sell products to customers. Extranet extends the intranet from one location to another across the internet by securing data flow, to another intranet to a business partner. In these way intranets of business partners, suppliers, creditors, distributors, customers, and the like are connected to extranets by agreements.

An Extranet requires security and privacy. These require firewall server management, issuance and use of digital certificate or similar means of user authentication, encryption of messages, and the use of virtual private networks that tunnel through the public network.

19.2.1 Characteristics of Extranet

The following are the important characteristics of the Extranet.

a) It is an extended internet-private business networks located outside of the corporate firewall.
b) It can be referred to an intranet that is partially accessible to authorized outsiders.
c) It is a network that uses the internet to link businesses with others that share the common goals.

19.2.2 Uses of Extranet

Companies can use an Extranet to:

a. Exchange large volumes of data using Electronic Data Interchange.
b. Share product catalogs exclusively with wholesalers or those in the Trade.

c. Collaborate with other companies on joint development efforts.
d. Jointly develop and use training programs with other companies.
e. Provide or access services provided by one company to a group of other companies, such as an online banking application managed by one company on behalf of affiliated banks.
f. Share news of common interest exclusively with partner companies.
g. The manufacturing companies can coordinate the design manufacturing, scheduling and delivery across supply chain.
h. With extranet the technology firms can support for their customers and partners and makes it possible for remote access for employees.
i. The financial services firms, by using extranet can reduce costs of proprietary networks.
j. With extranet the publishing companies can increase the speed of design and production cycles.
k. Other benefits:
    i. Quicker turnaround time v Improved communication v Decreased paper flow v Traceable correspondence v Better service v Lower overhead and expenses v Improved employee morale v Increased Margins. , v Flexibility and scalability. v Reduced transitional barriers.
    ii. Versatility

A brief list of examples of extranet could include: a) allowing suppliers access to relevant inventory levels. b). allowing clients to review their account records v allowing students to update address information in real time.

As with intranet, access is granted only where you establish that it is required. User access is controlled by the latest in security technologies, protecting sensitive material from intrusion.

What is the relationship between intranets, Extranets and e–commerce?

The answer has three parts. First, intranets, extranets and e-commerce have in common the use of Internet (predominantly web) protocols to

connect business users. Second, intranets are more localized and can therefore move data faster than more distributed extranets. (Bandwidth limitations also apply to e-commerce.) Third, the amount of control that network managers can exert over users is different for the three technologies.

On an Internet, administrators can narrowly prescribe access and policy for a fixed group of users. For example, a company could specify Red Hat Linux as its standard desktop operating system, and Netscape Communicator 5 as its standard browser and mail client. The company could then write intranet workflow applications that leverage the uniform computing environment, over which it exercises strong control.

On a business-to business Extranet, system architects at each of the participating companies must collaborate to ensure a common interface and consistent semantics (data meanings). Since one company cannot reasonably enforce standards on its trading partners, extranet application developers must take into account a wider range of technologies than the case for intranets. For example, one company participating in an extranet might be using Microsoft Internet Explorer, another Netscape Navigator 4.5 and another Navigator Gold 3.x In order to collaborate via extranet, the applications have to perform adequately on all represented platforms.

The same is true, even more, for e-commerce, in which the trading partners may be completely unknown to one another. This is the case when you walk into a supermarket: the common interest in communication is based on the need to transact business, and not necessarily on a long-term trust relationship. Thus, e-commerce applications often support a level of security and transactional integrity (for instance, non-repudiation of orders) not present in intranet or extranet applications.

19.3 E-MAIL

E-mail is an electronic message sent from one computer to another. We can send or receive personal and business-related messages with attachments, such as pictures or formatted documents. We can even send songs and computer programs.

The e-mail communication is incredibly simple. A person with a PC and a modem to connect to the network can communicate with the other(s) connected to the network. The message can be prepared and sent instantly. The other person finds the e-mail when he checks his mailbox and may replay to the message in the same way. The message sent is private and no other person can read it.

Each user of e-mail service has a user ID or password serving as e-mail address. First thing to do is to get online using modem and communication software. Now the user can prepare his message in the form of a document using a word processor. The e-mail address of the recipient has to be typed in before the message is sent,

With e-mail each person connected to the system is allotted a mailbox and the software required for sending and receiving e-mail. The mailbox is simply a file into which the e-mail system stores electronic documents. The user can check his mailbox for messages over the network. The sender specifies his identity and that of the recipient. The sender then prepares the document or retrieves the stored document and sends it.

E-mail is a document communication facility. To ensure that the recipient also understands the emotions as well, a set of special symbols is used to convey some non-verbal signals. A few of such symbols are given below.

Symbol	Emotion
: -	Humor
:)	Smile
:(	Frown
:/)	Not funny
P- Private: *	Kiss
(: - (	Very sad

E-mail is the transmission of information electronically from terminal to terminal. The document is prepared in a word processor and is mailed electronically. The basic facilities in email include message creation, message transfer and post delivery service. The e-mail service may be traditional mainframe based or minicomputer based or LAN based system

with PCS to access from.

19.3.1 How E-Mail Works?

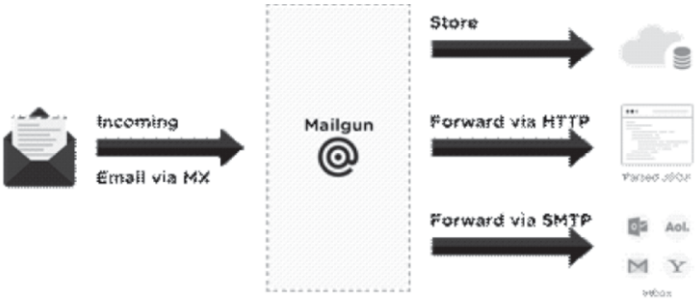
The first thing to be done is to type the message and the e-mail address of the recipient. Once the 'send' button is clicked, this e-mail is sent through the telephone line after its conversion into analog signal by the modem. The e-mail message arrives to the service provider's server. If the server recognizes the e-mail address as valid, the mail will be sent either through the network of the service provider or through internet gateway to the service provider of the recipient.

To send e-mail, we need a connection to the Internet and access to a mail server that forwards the mail. The standard protocol used for sending internet e-mail is called SMTP, short for Simple Mail Transfer Protocol. It works in conjunction with POP servers. POP stands for Post Office Protocol.

When we send an e-mail message, our computer routes it to an SMTP server. The server looks at the e-mail address (similar to the address on an envelope), then forwards it to the recipient's mail server. Once the message arrives at the destination mail server, it's stored until the addressee retrieves it. We can send e-mail anywhere in the world to anyone who has an email address.

With the advent of MIME, which stands for multipurpose Internet Mail

E-mail Route



Extension, and other types of encoding schemes, we can not only send messages electronically, but we can also send formatted documents, photos, sound files, and video files.

19.3.2 Infrastructure Requirement for E-Mail v Personal Computer

a. Telephone Connection v Modem
b. Mailing software viz., Outlook Express or Netscape communicator or Internet Explorer etc.

Advantages of E-mail

Messages can be prepared and sent any time convenient for the sender. Message can be received at the convenience of the recipient.

a. The transmission takes place instantly and the message gets stored in the mailbox of the recipient.
b. The system can confirm delivery of message. Copies of message can be sent to multiple recipients.
c. It reduces paper work.

Disadvantages

Recipients must be having e-mail connectivity. They must have computer terminals, modem and telephone.

a. They must be subscribing to the same e-mail service provider.
b. Poor telecommunication affects the quality of message transmitted.
c. Despite all the disadvantages e -mail is a cheap form of information transmission. INDONET, NICNET, DARTMAIL and ICNET provide this service in India. A user can be a subscriber to such e-mail service providing agencies and use their facility.

19.3.3 E-Mail Addressing Pattern

Internet e-mail addresses typically have two main parts: for instance: jobberman@nia.com.

First there is the user name (jobberman) which refers to the recipient's mailbox. Then there's an axon sign (@). Next comes the host name (nia), also called the domain name. This refers to the mail server, the computer where the recipient has an electronic mailbox. It's usually the name of a

company or organization.

The end of the domain name consists of a dot (".") followed by two or three letters (such as .com and .gov) that indicate the top-level domain. This part of the domain name indicates the type of organization or the country where the host server is located. We already had a broad explanation on this in chapter 10, (Internet).

19.3.4 E-Mail Messages

E-mail messages are similar to letters, with two main parts. The header contains the name and address of the recipient, the name and address of anyone who is being copied, and the subject of the message. Some e-mail programs also display your name and address and the date of the message.

The body contains the message itself. Just like when sending letters, we need the correct address. If we use the wrong address or mistype it, our messages will bounce back with messages like – Return to Sender, Address Unknown routine.

When we receive an e-mail, the header tells us where it came from, how it was sent, and when. It's like an electronic postmark.

Unlike a letter, which is sealed in an envelope, e-mail is not as private. It's more like a post card. Messages can be intercepted and read by people who really shouldn't be looking at it. We should therefore avoid including any confidential information unless we have a way to encrypt it.

19.3.5 Usage of Mails:

Incoming mails can be checked on a daily basis at least 3 times a day.

a. We can use the e-mail facility judiciously and extensively for communicating with Circle Office / Head Office/ Service Branch / Customers.

b. Communicate e-mail id to all domestic and overseas customers and use the facility for passing on information regarding new schemes launched by Bank and other important information to them.

c. Encourage customers to contact branch through e-mail for information regarding their urgent banking requirements.

d. Use the facility as a marketing tool to attract new customers, exchange greetings with existing customers and also inform them about recent happenings in the locality.

19.4 CHAPTER SUMMATION

1. An Extranet is a private network that uses the internet protocol and the public telecommunication system to securely share part of business information or operations with suppliers, vendors, partners, customers, or other businesses.
2. E-mail allows users to send and receive messages anytime and anywhere in the world.
3. E-mail is popular as it is fast, flexible, and reliable

19.5 DISCUSSIONS

1) Write short notes on Extranet.
2) State the characteristics of Extranet.
3) What are the different uses of Extranet?
4) What is E-mail? Explain how it works.
5) List out the advantageous and dis-advantages of E-mail.
6) Create an E-Mail ID, Try to receive and send messages to your friends.

19.6 CHAPTER PROGRESS

1. An Extranet is a private network that uses the internet protocol and the public telecommunication system to securely share part of business information or operations wit-suppliers, vendors, partners, customers, or other businesses.

2. To use the mailing software you will need;

i. Personal Computer
ii. Telephone Connection iii. Modem
iv. Mailing software

CHAPTER TWENTY

MOBILE COMPUTING

20.0 Aims and Objectives
20.1 Introduction
20.2 Types of Mobile Computers
20.3 Chapter Summation
20.4 Discussions
20.5 Chapter Progress

20.0 AIMS AND OBJECTIVES

After reading this lesson you will be able to understand:

1. What is mobile computing
2. Types of mobiles computers

20.1 INTRODUCTION

Mobile Computing is a generic term describing your ability to use technology 'un tethered' (wireless), that is not physically connected, or in remote or mobile (non static) environments. The term is evolved in modern usage such that it requires that the mobile computing activity be connected wirelessly to and through the internet or to and through a private network. This connection ties the mobile device to centrally located information and/or application software through the use of battery powered, portable, and wireless computing and communication devices. This includes devices like laptops with wireless LAN or wireless WAN technology, smart mobile phones, wearable computers and Personal Digital Assistants (PDAs) with Bluetooth or IRDA interfaces.

20.2 TYPES OF MOBILE COMPUTERS

Many types of **mobile computers** have been introduced since the 1990s, including the: a. Laptop computer

b. Sub-notebook

c. Personal digital assistant (PDA)
d. Portable data terminal (PDT)
e. Mobile data terminal(MDT)
f. Tablet personal computer
g. Smart phone
h. UMPC

a. Laptop computer

A laptop computer, simply laptop (notebook computer or notebook), is a small mobile computer, which usually weighs 2-18 pounds (1-6 kilograms), depending on size, materials, and other factors. Laptops usually run on a single main battery or from an external AC/DC adapter which can charge the battery while also supplying power to the computer itself. Many computers also have a 3 volt cell to run the clock and other processes in the event of a power failure.

As personal computers, laptops are capable of the same tasks as a desktop computer, although they are typically less powerful for the same price. They contain components that are similar to their desktop counterparts and perform the same functions, but are miniaturized and optimized for mobile use and efficient power consumption. Laptops usually have liquid crystal displays and most of them use different memory modules for their random access memory (RAM), for instance, SO-DIMM in lieu of the larger DIMMs. In addition to a built-in keyboard, they may utilize a touchpad (also known as a track pad) or a pointing stick for input, though an external keyboard or mouse can usually be attached.

b. Sub-notebook

A sub-notebook is a small and lightweight portable computer, with most of the features of a standard notebook computer but smaller. The term is often applied to systems that run full versions of desktop operating systems such as Windows or Linux. Sub notebooks are smaller than notebook computers but larger than handheld computers and ultra-portables. They often have screens that are 10.4" (diagonal) or less, and weigh less than 1 kg; as opposed to full-size laptops with 12" or 15" screens and weighing 2 kg or more. The savings in size and weight are usually achieved partly by omitting ports or having removable media/optical drives; sub notebooks

are often paired with docking stations to compensate. Sub notebooks are a niche IT product and rarely sell in large numbers.

c. Personal digital assistants (PDAs)

Personal digital assistants (PDAs) are handheld computers, but have become much more versatile over the years. PDAs are also known as pocket computers or palmtop computers. PDAs have many uses: calculation, use as a clock and calendar, accessing the Internet, sending and receiving E-mails, video recording, typewriting and word processing, use as an address book, making and writing on spreadsheets, scanning bar codes, use as a radio or stereo, playing computer games, recording survey responses, and Global Positioning System (GPS). Newer PDAs also have both color screens and audio capabilities, enabling them to be used as mobile phones (smart phones), web browsers, or portable media players. Many PDAs can access the Internet, intranets or extranets via Wi-Fi, or Wireless Wide-Area Networks (WWANs). Many PDA's employ touch screen technology.

d. Mobile data terminal (MDT)

A mobile data terminal (MDT) is a computerized device used in police cars, taxicabs, courier vehicles, service trucks, commercial trucking fleets, military logistics, fishing fleets, warehouse inventory control, and emergency vehicles to communicate with a central dispatch office.

Mobile data terminals feature a screen on which to view information and a keyboard or keypad for entering information, and may be connected to various peripheral devices. Standard peripherals include two-way radios and taximeters, both of which predate computer assisted dispatching. MDTs may be simple display and keypad units, intended to be connected to a separate black-box or AVL (see below) computer. On the other end of the spectrum, MDTs may contain full, PC-equivalent hardware. The function and programmability of the devices is similarly broad.

e. Tablet PC

A Tablet PC is a notebook- or slate-shaped mobile computer. Its touch screen or digitizing tablet technology allows the user to operate the computer with a stylus or digital pen, or a fingertip, instead of a keyboard

or mouse.

The form factor offers a more mobile way to interact with a computer. Tablet PCs are often used where normal notebooks are impractical or unwieldy, or do not provide the needed functionality.

f. Smart phone

A smart phone is a full-featured mobile phone with personal computer like functionality. Most smart phones are cell phones that support full featured email capabilities with the functionality of a complete personal organizer. An important feature of most smart phones is that applications for enhanced data processing and connectivity can be installed on the device, in contrast to regular phones which support sandboxed applications. These applications may be developed by the manufacturer of the device, by the operator or by any other third-party software developer. "Smart" functionality includes any additional interface including a miniature QWERTY keyboard, a touch screen, or even just secure access to company mail, such as is provided by a BlackBerry.

g. Ultra Mobile PC

The Ultra-Mobile PC (abbreviated UMPC), previously known by its codename Project Origami, is a specification for a small form factor tablet PC. It was developed as a joint development exercise by Microsoft, Intel, and Samsung, among others. Current UMPCs feature the Windows XP Tablet PC Edition 2005, Windows Vista Home Premium Edition, or Linux operating system and low-voltage Intel Pentium or VIA C7-Mprocessors in the 1 GHz range.

20.3 CHAPTER SUMMATION

1. Mobile computing is a form of wireless networking that uses common frequencies to permit networked devices move freely within the broadcast coverage area.
2. Many types of mobile computers are available. They are Laptop computer, Sub notebook, Personal digital assistant (PDA), Portable data terminal (PDT), Mobile data terminal (MDT), Tablet personal computer, Smart phone, UMPC.

20.4 DISCUSSIONS

1. Write short notes on mobile computing.
2. Explain the different types of mobile computers.
3. Discuss in detail about the various types of Mobile Computers.

20.5 CHAPTER PROGRESS

i). Laptop computer
ii). Sub-notebook
iii). Personal digital assistant (PDA)
iv). Portable data terminal (PDT)
v). Mobile data terminal(MDT)
vi). Tablet personal computer
vii). Smart phone
viii). UMPC

CHAPTER TWENTY ONE

SYSTEM ANALYSIS AND DESIGN

21.0 Aims and Objectives
21.1 Introduction
21.2 System Analysis and Design
21.2.1 System Development Life Cycle
21.3 Chapter Summation
21.4 Discussions
21.5 Chapter Progress

21.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. Meaning of a system
2. System development life cycle

21.1 INTRODUCTION

System development involves conceiving an information system project, implementing it and maintaining to the user's satisfaction. These information systems are developed to solve a problem, to make use of an opportunity, to comply with a requirement and to effect broad improvement in business process.

21.2 SYSTEM ANALYSIS AND DESIGN

Meaning of a system:

A system is a group of inter-related parts or components working together towards a common goal by accepting inputs and producing outputs in organize transformation process**.**

- The parts perform some function: there must be input and output flows to and from the system.
- The performance of this function must be measurable, which

implies monitoring.

- ❖ The parts are organized, which implies control of actions and a decision – taking process.
- ❖ The organized parts also mean that if a part has no interaction or connection with other parts, it is not in the system.
- ❖ The environment beyond the boundaries can affect and be affected by the system. Ø **Different resources are available for the system.**
- ❖ A number or sub – systems exist which interact with each other. There are four categories in particular.
- ❖ The information sub – system deals with the flow of information between parts of the system, and between the system and its environment. The control sub – system experts control on the system. The logistic sub – system collects resources, and feeds the system with resources.
- ❖ The process sub – system provides the functional output from the system. Thus, system is essentially a group of interdependent component together to achieve a specific and common objective. A collection of components that work together to realize a specific and common object forms a system. Basically there **are three major components in every system, namely input, processing and output.**

In a system the different components are connected with each other and they are interdependent, For example, a human body represents a complete natural system. We are also bound by much national system such as political system, economic system, and so forth. The objective of the system demands that some output is produced as a result of processing the suitable inputs.

21.3.1 System Development Life Cycle (SDLC)

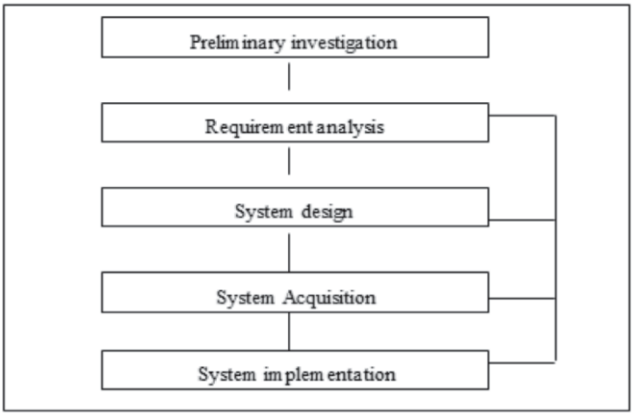
The systems development life cycle model has a well-defined iterative process. It involves a few phases. The development follows the phases fairly exactly. The process theoretically never ends as the cycle gets repeated, that is, on completion of one cycle the next cycle starts with preliminary investigation.

In this approach the systems design activities such as preliminary investigation, requirement analysis, systems design, systems acquisition and systems implementation are carried out in strict sequence.

The traditional system development life cycle stages are to be gone through serially and in strict sequence. Systems development life cycle is made up of the following stages:

a. Preliminary Investigation

It is an investigation into the problem that comes up with options for the management to consider for the proposed system change. The preliminary investigation examines the request for system change in detail to know precisely the requirements. A set of feasibility studies is used to ascertain the viability of the project. This includes technical feasibility, economic feasibility, operational feasibility and schedule feasibility. The report is submitted to the management for consideration and action.



Traditional Systems Development Life Cycle

The steps include:
Conducting preliminary analysis, determination of objectives, scope and constraints of the proposed system, developing alternative solutions, Estimate cost and benefits of each alternative, Submit a preliminary report with recommendations.

b. Requirement Analysis
If the management permits the system development to continue after studying the preliminary investigation report, new system requirements are analyzed in detail. After the analysis, the results are presented in requirement report to the management. Requirement is any feature that is to be included in the new system.

This process starts with the defining scope of system analysis and identifying users of the current system. Analysts carry out a study of current user requirements and deficiencies of the current system in meeting them. It describes the new system and the benefits it provides to the users. It also produces a requirement definition document.

Steps include; Gather data employing tools like document walk through, interviews, questionnaires, observation etc.

- ❖ Analyze the data using CASE tools, data flow diagrams, system flowcharts, decision tables etc.,
- ❖ Prepare a system study completion report.

c. Systems Design
The requirement analysis provides the input for designing a new system to meet the user requirements. The new system is planned in detail at this stage. Design translates the requirements into ways of meeting them. It produces specifications of a physical system that is expected to meet the requirements. Specifically this includes output design, input design, procedure design, database design and control design.

d. Systems Acquisition
Hardware, software and service needs of the new system are ascertained and vendors chosen for the acquisition.

This includes:

- Develop or acquire software
- Acquire hardware
- Test the system

e. Systems Implementation

The system is finally tested and put into operation. Implementation comprises all the activities involved in putting the system together physically and getting the people adopts the new system. This requires training for people and conversion of data and procedures to be in agreement with the new system.

Steps include:

- Train the operators and users. Convert to the new system
- Develop final documentation

f. Systems Maintenance

The system may need modifications or updating due to changes in requirements. If the changes are minor, they are incorporated into the system. If the changes are major, they start another cycle of system development.

Steps include:

- Perform system audit to see whether the new system implemented is as it should be. Perform evaluation of system performance against a set of criteria.

21.4 CHAPTER SUMMATION

1. System development involves conceiving an information system project, implementing it and maintaining to the user's satisfaction.
2. A system is a group of inter-related parts or components working together towards a common goal by accepting inputs and producing outputs in organize transformation process**.**
3. There are three major components in every system, namely input, processing and output.
4. Systems development life cycle is made up of the following stages: Preliminary investigation, Requirement Analysis, Systems

Acquisition, Systems Implementation, systems maintenance.

21.5 DISCUSSIONS

1) What is a system?
2) What are the different resources available for the system?
3) Explain in detail about system development life cycle.

21.6 CHAPTER PROGRESS

1. A

i). Preliminary Investigation
ii). Requirement Analysis
iii). Systems Design
iv). Systems Acquisition
v). Systems Implementation
vi). Systems Maintenance

B.

A system is a group of inter-related parts or components working together towards a common goal by accepting inputs and producing outputs in organize transformation process**.**

CHAPTER TWENTY TWO

INTRODUCTION TO INFORMATION SYSTEMS

22.0 Aims and Objectives
22.1 Introduction
22.2 Management Information System
22.2.1 Characteristics of MIS
22.2.2 Designing of MIS
22.2.3 Benefits of MIS
22.3 Chapter Summation
22.4 Discussions
22.5 Chapter Progress

22.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. Computer based information system and the need for computer based information system.
2. Management Information System and the characteristics of MIS.
3. Designing of MIS.

22.1 INTRODUCTION

Information is data that has been processed and is meaningful to the user. It is a resource, produced by information systems and is important to the operation and management of organizations. It should be noted that information is neither a natural resource, such as oil and coal nor a resource that is acquired from the external environment or the organization such as raw material or personnel. If it is designed suitably and properly managed, it can be the most effective resource of the organization.

Factors influencing the value of information in organizations:

The following factors are to be considered while processing the information.

a. Completeness.
b. Accuracy.
c. Timeliness - up to date.
d. Consistency.
e. Validity - unbiased, representative, verifiable.
f. Suitability - meaningful and relevant, formatted to suit the user's needs.
g. Distinctiveness.
h. Relevance.
i. Usability.
j. Accessibility.

The Information Processing Cycle

The information processing cycle includes the following steps:

a. Acquisition
b. Input
c. Validation
d. Processing (manipulation)
e. Storage
f. Retrieval
g. Output
h. Communication
i. Disposal/Archiving.

Let us see these steps one by one here under.

a. **Acquisition:** It is the collection of raw data from the outside world so it can be put into an information system.

b. **Input:** It is putting the acquired data into the information system.

c. **Validation:** It is checking the quality of the data before it is processed. Processing invalid data gives waste information.

d. **Processing (manipulation):** This is a key point. At this stage data is converted into information.

e. **Storage:** Unless we want to input the data every time we process it,

it is useful to store the data. We also may want to store information that we have produced so we need not have to keep repeating work.

f. **Retrieval:** This involves the reverse process of storage. The stored data or processed information is taken back for further use. It is called retrieval.

g. **Output:** All the previous steps are used to produce the results. The important output devices include the following:

- CRT (cathode ray tube) monitors and LCD displays
- Printers
- Sound cards/speakers

h. **Communication:** This is nothing but sending data or information to another place. This usually involves LANs (local area networks), WANS (wide area networks - LANs joined together), and the internet.

I. **Disposal:** This involves deleting data or archiving data. Issues involve the security of so-called "deleted" data. When data is no longer needed it can be deleted. Very sensitive data may needs more: when PCs delete data, they do not actually remove it from the disk. They just mark that part of the disk as "available for saving on". Thus data can stay on the disk and be easily restored by snoops. To really delete sensitive data it should be wiped out. That is overwritten with trash until it is no longer readable.

Archiving means taking the data off the main storage and storing it offline usually on floppy or CDs. If in the future the data we needed again, it is still available and it is not taking up important hard disk space. Businesses tend to archive rather than delete data - just in case.

Need For Computer Based Information System

The computer based information system is required because of the following reasons:

Information is a valuable source to gain competitive advantage.

a) Information helps line managers in taking effective control of operations.
b) Information makes the planning more realistic.
c) Information enhances customer relationship, maintenance of equipment, etc.
d) Information helps in decision making process.
e) Information helps in implementing business re-engineering.
f) Improve the efficiency.
g) Computer operations need information to process the data correctly and produce the desirable output.
h) Individuals need information for managing and operating the organization.
i) Organization needs information to improve the performance and growth.
j) Banker needs information to provide loans or granting credit.
k) Investors need information to know the financial status and the future prospects of the business units.
l) Government agencies need information systems for calculating taxation and taking regulatory measures.

In this context we shall discuss about the following information systems:

1. Management Information System
2. Office Automation Systems
3. Transaction Processing Systems
4. Decision Support Systems
5. Expert Systems

22.2 MANAGEMENT INFORMATION SYSTEM

Management information system is a general term for the computer systems in an enterprise that provide information about its business operations. It's also used to refer to the people who manage these systems. Typically, in a large organization MIS refers to an entirely coordinated system of computer expertise and management, including mainframe system and the entire network of computer resources.

In the beginning, business computers were used for the practical business of computing the payroll and keeping track of accounts payable and receivable. As application were developed that provided managers' with information about sales, inventories, and other data that would help in

managing the enterprise, the term "MIS" arose to described these kinds of applications. Today, the term is used broadly in a number of contexts and includes; decision support system, resource and people management applications, project management, and database retrieval applications.

Thus, MIS can be defined as "MIS is a set of inter related elements which work together to render classified and interpreted data that are usable and used by managers in the process of planning, organizing staffing, directing and controlling the major activities of business".

22.2.1 Characteristics of MIS

MIS generally has the following characteristics.

a. Management oriented

Beyond any doubt is the fact that MIS is a management oriented system. This could be understood from the terminology itself. The information processing carried out by MIS if always attempting at helping the management.

b. Management directed

Similarly, all the activities of MIS are initiated by the management. It is the management's need that the MIS strives to satisfy. Hence, MIS is management directed.

c. User-machine system

The concept of user-machine system implies that some tasks of MIS are done by the users while others are best done by machines. There is co-existence of both men and machines in MIS.

d. Integrated system

MIS hopes to provide the basis of integration of information processing. This leads to common data flows. Even though applications in a system are implemented one at a time, their design is guided by an overall plan. In essence information system is designed as a federation of small systems.

e. Involves large planning

The concept of MIS goes only with planning. There is a huge amount planning coupled with the installation and maintenance of MIS

f. Sub systems

Naturally, a vast system like the MIS will be having plenty of sub systems which are mutually related with defined with definite relationships and properly ordered. It is based on subsystem concept.

g. Use of models

MIS uses scientific and mathematical models for planning, organizing, directing and controlling for its analysis.

h. Database

One of the pre-requisites for installing, implementing and successful operating of MIS is data. Hence, there has to be a way to maintain data in data in data bases and there has to be a central database.

i. Information as a resource

MIS transforms data into information and the management is behind MIS. MIS provides procedure for measuring and matching cost of obtaining and using information.

j. Flexibility in use

MIS is so designed that it is flexible and adaptable to user requirements.

k. Others

MIS is predictive and related to organizational levels.

22.2.2 DESIGNING OF MIS

The basic decision has to take into account a general approach, so that suitable systems can be developed for different organizations depending upon their role, functions and decision making requirement. In each organization, data gets generated at different levels. This data when processed and analyzed becomes information which, when properly communicated in time for the decision making can result in decision actions.

Designing of MIS involves the following steps:

a. Defining the problem or decision area.
b. Setting of system objectives.

c. Establishing system constrains(both internal and external)
d. Determining information needs.
e. Determining information source.
f. Finding out alternative solutions.
g. Evaluating alternative solutions.
h. Selecting the best alternative.
i. Preparing decision report.
j. Implementing and monitoring the selected alternative.
k. Documentation.

a) Defining the problem or decision area

Undoubtedly problems exist in any dynamic business. What usually lacks is the clear identification of the problems and a priority system for their solution. The problem may be in the marketing where sales are poor or there could be problems in the inventory are where large stocks exist and every year it is increasing. Therefore, management must take the first step in MIS designing by formulating problems to be solved. The precise definition of the problems is crucial. Otherwise, the problem solver would be restricted to a solution or a system that is sub optimal or that encompasses more than it is needed.

b) System objectives

The system objective should clearly be stated in terms of the functions the information system is to perform. The objective could be to cater specifically for information needs of finance, personnel, material or any other specific area of business. It could also be to meet the total information needs of the organization. In short, system objective should be stated in terms of what managers can do and how effectively they would be able to function after their information requirements have been met. To give an example, in the field of inventory, the objective could be to design better decision rules so that various levels of inventory could adequately be controlled.

The following questions should be answered while laying down the objectives of MIS design:

(a) What is the purpose of the system?
(b) What is it expected to do?

(c) Why is it needed?
(d) What are the users and what are their objectives?

The objectives of MIS system design have to match the organization's objectives. The aim being to improve decision making, lower cost, meet customer demands and improve the image of the organization.

c) Establishing system constraints

In designing MIS the designer has to face certain limitations; sometimes called problem boundaries or restrictions. Constraints enable the designer to stipulate the conditions under which objectives may be attained and help to consider the limitations that restrict the design. To state it in another way, constraints, which are provided by the manager, user or the designer himself, limit freedom of action in designing a system to archive the objectives.

Constrains may be classified as (a) internal or (b) external to the organizations as shown in figure:

INTERNAL CONSTRAINTS

(i) Top management support

It is very essential for MIS system. A good environment for information system must be set. Approval and support of top management should be taken. Their feedback and guidelines definitely influence the kind of system managers may design.

(ii) Organizational policy

Considerations frequently set limits on objectives and modify an intended approval for design of a system. In every organization managers occupying various positions, influence information flow, particularly in a decentralized system. Also company policies frequently define or limit the approach to system design among these polices are those concerned with product and service, R & D, marketing finance and personnel.

(iii) Manpower

Perhaps the most signification constraint of all, is the one concerning people of MANPOWER. Men problem is probably the fact, most often

mentioned where failure to achieve expected results is concerned. Here we have the difficulties associated with the natural human reaction to change, the lack of interest and support, frequently met in systems design and operation.

(iv) Cost

It is a major resource limitation. The cost to achieve an objective should be compared with the benefits to be derived. The other resource requirements could be space, air conditioning, power etc... And other facilities for setting up the information system inadequacy of resources can greatly limit the system design.

(v) Acceptance

Acceptance of the computerized MIS system perhaps presents the most difficult aspect of the problem in organizations, as it causes a natural human reaction against the change.

(vi) Self-Imposed restrictions

There are those placed on the design by the manager or the designer. The data requirements, the data volume and the rate of processing are constraints imposed by the immediate users.

External constraints

I). Customer

Foremost among the consideration surrounding the external environments are those concerning the customer. Order entry, billing, and other systems that interface with systems of the customer must be designed with the customer's needs in mind. If certain outputs from the system sure not acceptable to the customer, a definite limitation is to be faced.

ii). Government

A variety of additional external constrains should be considered in addition to the customer. The government (central, state, local) imposes certain restrictions on the processing of data, in maintaining and in the conduct of business like taxes and reporting.

iii). Unions

Unions can affect the operation of systems involving members in matters such as compensation, grievances and working conditions.

iv). Suppliers

They are also an important group to be considered when designing information systems because these systems frequently interface with that group.

d) Determining information needs

A clear statement of information needs is fundamental necessity to good system design. Unless managers can provide the specifications for what they want out of an information system, the design effort will produce less than optimum results, If on the other hand, the user manager can define the objectives and spell out the items of information that are needed to reach the objective, he or she is, at least half way through in system

A manager needs information for a variety of reasons concerned with the management process. The type of need that he or she will have at various times for various purposes depends largely upon following factors:

Personal Attributes such as

I) Knowledge of information systems
ii) Managerial style i.e. Leadership style and decision making ability
iii) Manager's perception of information needs.

Organizational Environment such as

i) Nature of the company, ii) Level of management and
iii) Structure of the organization

e) Determination of information sources

The step for determining information needs is hardly completed, before we consider the information sources. Although some systems require considerable external information, for the most part, the natural place to turn for information is inside the firm –books, records, files, accounting documents etc. thus most analysis refers to the step of determining information requirements on analyzing the present system. We must not

only uncover information sources for the particular subsystem under consideration but also take into account how they fit into the overall integrated sources of information and techniques of analysis.

f) Finding out alternative solutions

Once the problem has been understood, the solutions for the problem are to be found out. Ideally, one has to attempt to find out more than one alternative solution, but it should not be much more. It should be narrow down to a few. Because having too many alternatives affects the problem solving process, increase costs and become unmanageable.

g) Evaluating alternative solutions

Each alternative has its own advantages and disadvantages that contribute to solving the problem in question. These must be evaluated and attached to the proposed alternative. In certain business problems, the costs and benefits are party intangible or immeasurable. In such a situation the problem solver should make approximations using surrogate measures and probabilities.

h) Selecting the best alternative

In this stage, the problem solver may have many alternatives which have more benefits than costs. In such a situation he applies a decision rule or a yardstick (e.g. rate of return or time etc.) to summaries and ranks the alternatives finally the best alternative is chosen.

i) Preparation of design report

The conceptual design report is, in a sense, a proposal for the expenditure of funds and for organizational changes. Because it is directed to management, it should have a concise summary of the problems that constitutes the system, the objectives, the general nature of the system, reasons why the concept was selected over others, and the time and resources required to design and implement the system.

j) Implementing and monitoring the selected alternative

Once, the best alternative or system has been selected it must be implemented and followed up. If it does not perform well and incurs more costs than implemented and controlled.

k) **Documentation:** For the smooth running of the MIS it is necessary that the following types of documentation are to be prepared:

I) For those providing input, a simple overview of the system, a clear description of exactly what input is expected and a note above what input is not acceptable.

ii) For those running and maintaining the system, all the technical documentation generated during the development process.

iii) For those using the output, a simple overview of the system, a clear description of what the output means and a note about its limitations.

22.2.3 BENEFITS OF MIS

Information is needed in virtually every field, thought and action. But besides being essential to individuals who use it to achieve personal ends; information is also needed by managers in organizations. Managers at all levels must perform such basic tasks as staffing, directing and controlling. The success of any business is determined by the success of its managers in performing their activities. Activities in turn are being affected by the excellence in decision-making. The blood pool of better decisions is information decision making must be supported by quality information.

In short, quality information leads to better decisions enhance better managerial activates and, effective managerial performance leads to organizational effectiveness. It is MIS which is the supplier of information to the managers. Hence, the role of MIS is very important in every organization.

The analysis, design and implementation of MIS are more expensive and difficult. Even though expensive it is justified for several reasons:

1. **Timeliness:** Managers make decisions more quickly and take less time to solve the problems and give satisfactory solutions to the management.

2. **Accuracy**: Normally the organizations are in position to provide variety of regular reports. For the increased government regulations. Also the organizations have variety of customers, requires variety of reports. These reports are organizations by the

management accurately with the effective MIS.

3. **Reduction in inventory levels**: With effective MIS the inventory levels can be maintained at an optimum level which results into cost reduction.
4. **Better liquidity**: MIS provides for better liquidity by justifying account receivable, cash flow or living systems.
5. **Better work allocation**: MIS ensures the better allocation of work by evaluating the benefits of personnel allocation, maintenance control and production scheduling system. This results into reduction in work hours which lead to monetary benefits to the firms.
6. **Increase in sales**: Through effective MIS, one can access the profitability of distribution, marketing, finished goods, inventory control, and customer order systems. This may result into increase in sales.
7. **Reduction in maintenance costs**: MIS can be used as a measure for evaluating maintenance control system and spare parts inventory control systems. It ensures reduction in maintenance costs.
8. **Completeness:** In MIS, the system managers understand the management technique and the procedures, so they are able to produce the complete reports of a system.
9. **Accurate reports**: The MIS has the ability to provide the complete and concise reports. For example,
   - **(a)** Summary reports- Summaries all activities of the organization and present in the form of summary report.
   - **(b)** Demand reports- This reports will be prepared only when they are requested by the management.
   - **(c)** Customer reports- According to the specifications of the management it will be prepared.
   - **(d)** Exception reports- According to the conditions or exceptions the report is prepared.
   - **(e)** Responsibility-The MIS structure provides the boundaries of management responsibilities.

10) Other benefits: MIS provides the following other benefits.

(i) Ensures shorter response time.

(ii) Reduces the number of negative responses to customers.

(iii) Improves decision-making process.
(iv) Widens information bases for decision-making
(v) Facilitates data integration.
(vi) Simple and easy to understand.
(vii) Saves the precious time of managers.
(viii) Saves manpower.
(ix) Enhances the quality of decisions.
(x) Easy accessibility
(xi) Reduces data redundancy.
(xii) Improves productivity.

22.3 CHAPTER SUMMATION

1. The value of information in organizations is based on completeness, accuracy, timeliness, consistency.
2. The computer based information system is required to have effective control of operations, planning, to enhance customer relationship, maintenance of equipment, etc.
3. MIS refers to an entirely coordinated system of computer expertise and management, including mainframe system and the entire network of computer resources.
4. Designing of MIS involves various steps
5. MIS offers certain benefits like timeliness, accuracy, reduction in inventory levels, better liquidity, better work allocation, increase in sales etc.

22.4 DISCUSSIONS

1) What do you mean by information? List out the factors influencing the value of information.
2) Write short notes on information processing cycle.
3) What are the steps involved in information processing cycle.
4) What are the needs for computer based information system.
5) What are the different steps involved in designing an MIS (explain
6) Explain the various benefits of using MIS.

22.5 CHAPTER PROGRESS

1. A. MIS is a set of inter related elements which work together to render

classified and interpreted data that are usable and used by managers in the process of planning, organizing staffing, directing and controlling the major activities of a business.

B. Your answer may include any of the following:

a. Completeness.
b. Accuracy.
c. Timeliness - up to date.
d. Consistency.
e. Validity - unbiased, representative, verifiable.
f. Suitability - meaningful and relevant, formatted to suit the user's needs.
g. Distinctiveness.
h. Relevance.
i. Usability.
j. Accessibility.

CHAPTER TWENTY THREE

OFFICE AUTOMATION SYSTEMS AND TRANSACTION PROCESSING SYSTEMS

23.0 Aims and Objectives
23.1 Introduction
23.2 Office Automation Systems
23.3 Transaction Processing Systems
23.3.1 Transaction Processing Cycle
23.3.2 Features of TPS
23.3.3 Transaction Documents
23.3.4 Transaction Processing Modes
23.4 Chapter Summation
23.5 Discussion
23.6 Chapter Progress

23.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. What is office Automation and Transaction processing systems?
2. Important areas of office automation.
3. Transaction Processing Modes.
4. Transaction documents.
5. Features of TPS.
6. Transaction Processing Cycle.

23.1 INTRODUCTION

The introduction of minicomputer in to office in the late sixties has since then changed very significantly the way the work is done in office. Office automation is an assorted mix of technologies with the basic objective of improving the efficiency of office work. Office automation systems include the application of computer-based office- oriented technologies such as word-processing, desktop publishing, electronic mail, Teledex and teleconferencing.

Business transactions are certain events that occur routinely in a business firm such as purchase and issue of raw materials. The nature and volume of transactions depend on type and size of business. These transactions are to be recorded to measure efficiency of operations and resource use. The transaction processing system (TPS) is the most important and rich source of data for a business firm.

23.2 OFFICE AUTOMATION SYSTEMS

The important areas in office automation are:

1. Word processing
2. Desktop publishing
3. Word processing
4. Electronic mail
5. Facsimile (FAX)
6. Voice Mail
7. Teleconferencing
8. Electronic fund transfer
9. Image storage and retrieval systems
10. Multimedia systems

1. Word processing

Word processing permits typing in documents, manipulation of such documents and their storage and retrieval.

2. Desktop publishing

This uses computer hardware and software to produce documents of professional print quality. The use can combine test, artwork, photos and a variety of fonts to produce the document.

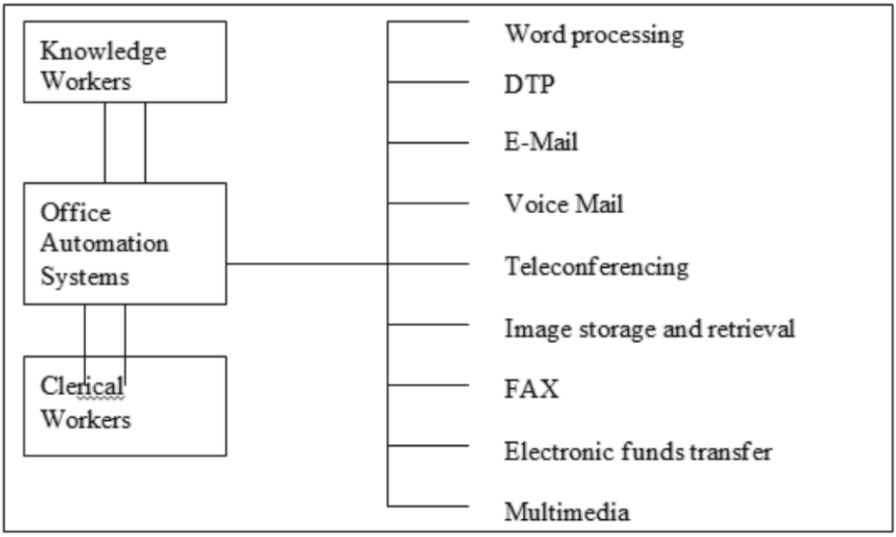
3. Electronic mail

E-mail is the fastest growing communication mode. Computer network facilitate communication between computers. The electronic transfer of messages between computers is quick, convenient and economic.

4. Facsimile (FAX)

The FAX machine sends and receives text and images. The text and images are converted into digital form and at the receiving end it is

converted into text and image form.



5. Voice Mail

Voice mail sends digitized speech over phone to a mailbox and the message is digitally stored at the receiving end, which can be accessed using telephone.

6. Teleconferencing

It is the use of telecommunication technology to see people face to face without their physical proximity to each other. The participants gather in specially equipped rooms capable of simultaneous audio and video transmission.

7. Image storage and retrieval systems

These systems convert paper documents into electronic files and images for easy storage and retrieval.

8. Electronic fund transfer

It is a facility to transfer funds between accounts of customers with banks. At the point of sale counter customers presents his clerk and keys in a code and if the card and coke tally the bill amount id transferred to the account of

the retailer and the customer's account is updated.

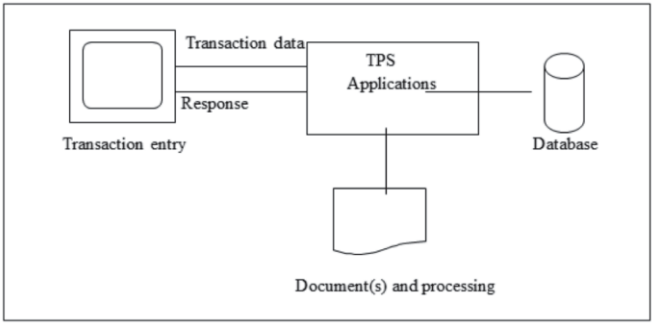
9. Multimedia systems

The multimedia systems store. Retrieve and process different types of data such as text, graphics, audio, video and animation. They facilitate information storage, retrieval and presentation in a variety of impressive ways.

23.3 TRANSACTION PROCESSING SYSTEMS

The transaction processing system (TPS) was the earliest form of computerized management information system. Originally, business transactions were processed manually. This was partly replaced by machine-assisted data processing systems. Gradually, electronic data processing was introduced to record business transactions. TPS is today an integral part of computer-based information systems. It is very difficult to imagine an organization without a functional TPS. For example, if an airline reservation system breaks down for a day or two, it will cripple the company and the flights will be in disarray causing untold miseries to customers.

In a business firm, there are two types of flows in and out of the firm. The first is a physical flow. It is the flow of inputs through various processes within the firm and the output of products and services out of the firm. The second is information flow. Information system tracks the physical flow. The physical flow of input and output is measured and recorded. These records are the sources of data for information corresponding to the physical flow.



The operations management takes care of the physical flow of resources and the transaction processing system takes care of the information flow. The transaction processing system processes all transactions and records them. This results in generation of transaction data which are structured and stored in databases. Apart from recording routine transactions, TPS also updates master files and databases.

23.3.1 TRANSACTION PROCESSING CYCLE

Transaction processing is a basic activity in organizations. It is a routine and repetitive activity that triggers a few other activities like updating database and generation of documents forming a cycle. The transaction processing cycle consists of six steps such as:

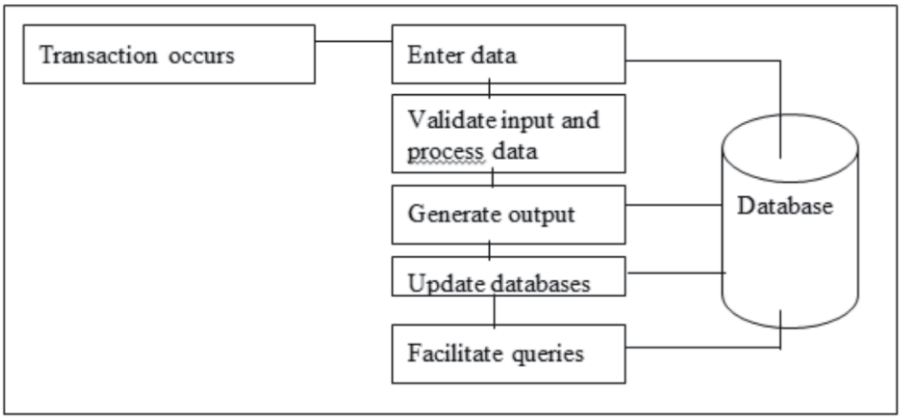
a. Data entry
b. Input data validation
c. Transaction processing and validation of results
d. File and database maintenance
e. Document and report generation, and
f. Inquiry processing

The transactions are measured in some convenient unit for recording such as money unit for expenses, hours in case of labor etc. Data pertaining to the transaction must be entered into the system. The source of this data usually is a document such as sales order from customers, invoice from suppliers etc., these are called source documents and they provide the basic data for TPS. The data is entered using either the traditional data entry methods or the direct data entry methods. In the former method the source documents like purchase order are prepared and usually accumulated into batches. The direct entry method uses automated systems for data capturing and recording. Point of sale terminals, optical scanners and MICR devices are used in capturing data and transferring data to computers in real time for transactions processing.

Input data validation is the next step in TPS. It checks the accuracy and reliability of data by comparing it with range data or standards etc. It involves error detection and error correction. Checking for errors include checking the data for appropriate format, missing data and inconsistent

data. If the data value falls outside the normal range it is invalid. For example, if a firm's orders for materials in kilograms ranging from 100 to 1000 kilograms and if that range is accepted as normal data range for purchase orders, then this range is coded into the program for validation checking. That whenever a purchase order is prepared, as soon as quantity is entered in the appropriate column the system check whether the quantity entered is between 100 and 1000. Otherwise it will give an error message as "Check the Quantity Entered, it is out of range" or some other error message as is coded.

Processing of transaction data is the next step. This involves some computation, checking and comparing etc. For instance, if it is a credit sale transaction, then the total value of the transaction has to be computed, the system should check whether the value is within the credit limit sanctioned to the customer, it should check the availability of stock, delivery data possible etc.



Once the transaction is processed, certain output needs to be generated. The output may be some documents like sales invoices, pay slips etc. Or screen displays or the output data may use to update related databases. Files and databases have to be updated with each transaction or each batch of transactions. In case of applications that are not time critical, the transactions may be processed in batch mode. Certain systems like airline reservation require updating with every transaction for giving status

information in real time. Direct data entry devices have to be used to capture transaction data and update related files and databases to provide current information to users.

Inquiry processing is another activity of transaction processing system which involves providing information on current status like inventory levels, customer credit limit, dues from a particular customer, inbound supply, et cetera. The inquiry response is pre-planned and the on-screen display or output is formatted for the convenience of the requester.

A business transaction with a customer involves a good or service that a customer want and the business provides for a price. The TPS supports the delivery process.
To complete a transaction with an external entity like customer, supplier etc. a series of activities is involved such as checking of account, current inventory balance, delivery time and price.

For instance, the transaction at a bank counter involves checking of account balance, withdrawal of money or deposit of money. In the case of some transactions, an activity serves as a trigger and a series of activities follow it. For example, a sales order from a customer is followed by a number of activities; some of these are queries like:

- ❖ Checking whether the customer is an existing or a new customer.
- ❖ Checking customer's credit limit to know whether the transaction is within the permitted credit limit or not.
- ❖ Checking inventory balance to know whether the order can be fulfilled within the time the customer needs it.
- ❖ Checking production schedule to know how much will be added to finished stock at the end of a production period.
- ❖ Checking of back orders to know how much stock will be left to meet this sale order.
- ❖ Once this querying is over and if adequate stock is available for meeting the order, the sales order is approved and the transaction is processed. This involves;

Debiting customer account with the value of goods, Crediting sales file with the value of goods, Updating inventory file with the quantity of stock

sold, Generating a packing list for the Dispatch department to assemble the order, Generating documents like sales invoice bill of exchange etc., Packing the goods and handing them to the delivery staff, and Delivering the goods.

TPS actually tracks the physical workflows. Each operation of the workflow is recorded. At each of these points in the sales order processing, the information about the state of the order is recorded.

23.3.2 FEATURES OF TPS

TPS is a fundamental activity subsystem of information system and plays a very critical role in any organization. Some of the major features of TPS are as follows:

1. Integration tool

TPS integrates the various departments in an organization. Each department will generate data and these transaction data flows into a centralized database. The common database provides the raw data for information generation for various decision makers. TPS thus integrates the various functional units of an organization.

2. Links customers with the organization

TPS also connects customers with the organization's warehouse, plant and management. If TPS fails, it may cut the link with customers and organization cannot transact business with them.

3. Inputs

Processing involves sorting, listing, merging, updating etc. The inputs are transaction data like customer code, name product, quantity price etc.

4. Output

The output includes invoice, sales reports, lists, summaries, and inquiry responses. These are the results of enquiry processing, report processing and interactive processing.

5. The users

TPS is designed to support lower level management. The transactions are

highly structured and routine in nature. Applications are developed to facilitate data capture and recording. Mostly, operations personnel and supervisors are the user4s of transaction processing system.

6. User Department Specific
TPS is designed for each department to cater to its special data processing needs. Thus, production department will have a TPS for processing transactions in the department; marketing department will have another TPS for it and so on.

7. Highly structured
TPS is highly structured. Business transactions are routine events with relatively very high frequency like those of inventory management, payroll processing, accounting etc. Hence, these are early candidates for computerization in most business firms.

8. Scope for cost savings
Since manual transaction processing requires too many hands and are often inefficient, most organizations computerize transaction processing. This results in cost savings and drastic improvement in efficiency of service and information availability.

23.3.3 TRANSACTION DOCUMENTS
Processing of transactions results in certain documents. These documents may be classified into any of the following types:

(a) Informational Documents
These documents just inform that something has taken place or is taking place. For example, a sale confirms that the order has been received from the customer and has been verified.

(b). Action Oriented Documents
These documents need to be acted upon. For example, a purchase order initiates a purchase. Similarly a production order instructs the production department to start production of the products mentioned in the production order.

(c). Investigational Documents

These are generated on an exceptional basis. For example, whenever operations are not conforming to the range of deviations permitted, the variations are tracked and analyzed. A report is generated to enable the control point to take corrective action.

The reports or outputs generated by the TPS can also be classified into the following categories:

(a). Pre-planned Reports

Formats of these reports are pre-designed. These reports are frequently generated to meet information requirements of planning and control of actions. Most of these reports are periodic in nature like daily report, weekly report, monthly report etc. for example, weekly sales analysis report submitted to the sales manager helps him to know whether the sales targets for the week were met or not. If the targets were not met, the reasons for failure to meet the targets are also analyzed and mentioned in the report. This enables a manager to take corrective action.

(b). Pre-planned Enquiries

For the smooth and deficient functioning of any business, a lot of status information will be needed. For example, if a sale order comes from a customer, the sales clerk needs some status information about the stock of that particular inventory item, pending orders, credit limits in case of credit transaction etc. before he confirms the order. Most of this type of status information needs can be met through built-in query facility.

(c). Ad-hoc Reports and inquiry Responses

These reports and inquiries are infrequent or are not anticipated. They are needed to take some non-routine decisions or actions. For example, at the time of wage negotiation with its workers, if a firm is considering offering a new incentive scheme, the personnel manager / the finance manager may want to know the implications of this decision in terms of financial obligations. This information need cannot be anticipated in advance. Hence, such unique information needs have to be met by ad-hoc reports and enquiry facility.

(d). User Machine Dialogue results

For interactive decision making like in DSS, the decision maker has to enter into a dialogue with the system to generate more useful information. The results are interactively generated and displayed on the screen.

23.3.4 TRANSACTION PROCESSING MODES

Transactions may be processed individually or in batches. Similarly, the processing may be done at local offices or at the headquarters of companies. The type of processing depends on a set of factors like the volume of data, complexity of data processing operations, processing time constraints, computational demands and the degree of decentralization of authority. Thus, the processing modes are as follows:

(a). Batch Processing

Under this method transactions are accumulated into batches which are processed periodically. Most organizations handle a large number and variety of transactions every day such as cash sales, credit sales, sales commission, customer credit, consignment sale, advertising, etc., in marketing area. An efficient way to process these transactions is to collect all transactions of the same type of a particular period of time and process them as one batch of transactions. Thus, all sales transaction of a day of a particular product is processed once in a day or period. All these transactions are entered into the system at one time. This enables data processing personnel to better control the entire processing cycle for that type of transaction, and leads to more efficient scheduling of computer time.

(b). On-line Processing

The term on-line refers to the fact that the input/output files, data files and related equipment are connected to the computer such that a transaction may be entered at once or information may be retrieved immediately any time. Each transaction is entered into the system as at when it arises. There is no waiting for a minimum number of transactions to enter transaction data into the system.

(c) On-line, Real Time Processing

If the transaction is processed singly and as it occurs without any loss of time between the event and recording of the event, the processing is in on-

line, real time mode. It means that the files for the transaction type are kept on-line, that is electronically connected to the computer, and the transaction is processed quickly, for example airline reservation.

The concept of real time means that data is entered relatively quickly as they arise and updated information is available without loss of any time between data entry and information retrieval. Real time processing usually requires dedicated terminals connected to the central computer. An input transaction triggers an immediate processing of data with the response being returned in seconds, for example, on-line stock trading.

(d) Distributed processing

This arose out of the need to channel data processing power to where data actually arise and where it can be processed more efficiently. That is, some processing power is distributed to local or regional level officers by installing computers there rather than centralizing it at the headquarters. The detailed information required for daily operations remains at the local level and the summary information required at higher levels for planning and controlling overall operations is forwarded to the central computer.

(e) Online Transaction Processing Systems

Airlines reservation system, online securities trading system, electronic banking, railway reservation system, hotel room booking system etc., are examples of on-line transaction processing system.

23.4 CHAPTER SUMMATION

1. Office automation is an assorted mix of technologies with the basic objective of improving the efficiency of office work.
2. The important areas in office automation include word processing, desktop publishing, electronic mail, facsimile (FAX) etc.
3. Transaction processing is a basic activity in organizations. It is a routine and repetitive activity that triggers a few other activities like updating database and generation of documents forming a cycle.
4. The transaction processing cycle consists of six steps such as data entry, input data validation, transaction processing, and validation of results and so on

23.5 DISCUSSIONS

1) Explain in detail about the important area in office automation.
2) Explain in detail about transaction processing cycle.
3) Explain in detail about the features of transaction processing system.
4) What are transaction documents? Explain.
5) Write notes on transaction processing modes.

23.6 CHAPTER PROGRESS

1. Office automation systems include the application of computer-based office- oriented technologies such as word-processing, desktop publishing, electronic mail, teletext and teleconferencing.

The important areas in office automation are:

i). Word processing
ii). Desktop publishing
iii). Word processing
iv). Electronic mail
v). Facsimile (FAX)
vi). Voice Mail
vii). Teleconferencing
viii). Electronic fund transfer
ix). Image storage and retrieval systems
x). Multimedia systems

2. Modes of Transaction Processing systems
i). Batch Processing
ii). On-line Processing
iii). On-line, Real Time Processing

3. Transaction Processing Circle Distributed processing
i). Data entry
ii). Input data validation
iii). Transaction processing and validation of results
iv). File and database maintenance
v). Document and report generation, and
vi). Inquiry processing

CHAPTER TWENTY FOUR

DECISION SUPPORT SYSTEMS

24.0 Aims and Objectives
24.1 Introduction
24.2 Decision Support Systems
24.3 Types of DSS
24.4 Characteristics of DSS
24.5 Components of DSS
24.5.1 DSS Capabilities
24.6 Group Decision Support System (GDSS)
24.7 Typical GDSS Capabilities
24.8 Chapter Summation
24.9 Discussion
24.10 Chapter Progress

24.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. Types of DSS
2. Characteristics Of DSS
3. Components of DSS
4. DSS Capabilities
5. Group Decision Support System (GDSS)

24.1 INTRODUCTION

A decision support system is a computer application that helps users analyze problems and make business decisions more confidently. It uses data routinely collected in organizations and special analysis tools to provide information support to complex decisions. For example, a firm's sales department may be interested in analyzing various sales decision options. The decision support application might gather data, present the data graphically and help in evaluating various options. It may use past

sales figures, project sales based on sales assumptions for each alternative considered and display information graphically. It may also use artificial intelligence to enhance its decision support capability.

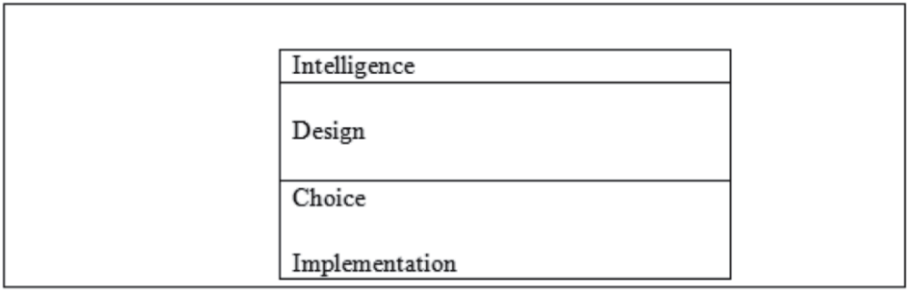
Decision Support System assists managers in making unstructured decisions. The system enables them to interact with the database, model base and other software. It enables the users to generate the information they need rather than depend on some reports produced according to some anticipated information needs. DSS is more suited to handling unique and non-routine decision problems. In many situations the problem itself may not be easily identified. Similarly, identifying alternatives, identifying outcomes of each alternative considered, evaluation of alternatives etc. Pose problems to the decision maker. Each problem might require a different approach to problem definition, analysis and resolution. Not only that it is difficult to solve such problems, it is also possible that the decision process and solution vary with the decision maker.

24.2 DECISION SUPPORT SYSTEMS

DSS is designed to support managerial decision-making, usually, at middle and top levels of management. Decisions made at the top level are mostly futuristic and non-repetitive in nature. Such decision situations are highly uncertain and even specification of information requirements for decisions are difficult. They are classified as non-programmable or unstructured decision situations. The impact of such decisions will be seen throughout the organization and cost of a wrong decision is usually very high, for example a decision to sell off a line of business. This is in sharp contrast to programmable or structured decisions where the decision procedure can be well defined and every information requirement can be pre-specified. Most of the decisions taken at lower levels of management fall into this category. For example, a decision to replenish stock of an inventory item is a highly structured decision taken at the operational level. DSS is intended to help managers making unstructured decisions. 'The system includes a database, various models (Mathematical models for optimization etc.) and an interface for the manager (usually a terminal) to interact with the system. The manager takes data from the database, selects appropriate model or models and analyses the data using these models to know the probable results of various actions.

DSS is thus an interactive computer system with many user-friendly features aimed at helping non-computer specialist managers in making plans and decisions on their own. With the recent advances in computing technology, particularly the powerful microcomputer and interactive devices, the uses of DSS is expanding rapidly as these managers find it easy to access databases and model base for retrieving and analyzing data.

DSS contains a database, models and data manipulation tools to help decision makers. It is useful where decisions are semi-structured or unstructured. The decision rule for a structured decision can be pre-specified. Hence, it is possible to automate such problem solving.



Intelligence activities are targeted at discovering problems of organizations. The information reporting system can handle most of these information requirements. In the design phase, alternative solutions to the problem identified are generated. This stage requires more focused information and more intelligence based systems like DSS and Knowledge based systems. Choice phase involves selecting the right alternative. This requires thorough evaluation of the consequences of all the alternatives under consideration in terms of risk and return, and its impact on problem area.

Information requirements at various stages of Decision-making and the type of systems:

Stage	Information required	Example system
Intelligence	Exception reporting	IRS
Design	Simulation prototype	DSS, KWS

Choice	"What if" analysis	DSS, large models
Implementation	Graphics, Charts	Microcomputer and Mainframe decision aids

Decision implementation is a critical phase. Managers are anxious about the results of decision implementation right from day one of implementation. In this phase, managers call for information on implementation of decision such as stage of implementation, time and cost involved, implementation constraints, and impact of implementation.

DSS can support repetitive or non-repetitive decision-making. It provides capabilities for repetitive decision-making by defining procedures and formats. For example, an insurance agent may use a DSS package to help clients in choosing insurance schemes. With the privatization of insurance in the country, innovative insurance products are being introduced. An investor will find it difficult to properly identify an insurance product matching his or her requirements. The agent can carry a laptop with a DSS for insurance products to his clients. The DSS can be used by the sales agent to demonstrate to the clients the details of each scheme in terms of risk covered bonus, maturity value, premiums etc. and help the clients arrive at their decisions to purchase insurance policy.

DSS can also help non-routine decision-making. In fact its utility is high when non-repetitive decisions are made. For solving a non-repetitive problem, the DSS provides data, models and interface methods to the user to select and analyze data. For example, a marketing manager might want to analyze the potential demand for new products that the company is planning to introduce. The marketing manager can use a DSS to forecast the demand using relevant data about the market obtained from some database service firms like Centre for Monitoring Indian Economy. The analysis will provide new insights into the market behavior and product performance that will help the manager in introducing new products into the market.

24.2.1 TYPES OF DSS

Basically, there are two types of DSS. One is data-driven DSS and the other is model driven DSS. The data driven DSS, helps in generating

useful information from huge quantity of data in organizational databases, data warehouses and websites. Data mining techniques are employed to generate useful information. The model-driven DSS contains mathematical models to carry out "what if" analysis and sensitivity analysis.

24.2.2 CHARACTERISTICS OF DSS

- ❖ It is designed and run by managers.
- ❖ It contains a database drawn from internal files and external environment.
- ❖ It focuses on decision processes rather than on transaction processing.
- ❖ It is concerned with a small area of managerial activity or a small part of a large problem.
- ❖ It permits managers to test the probable results of alternative decisions.
- ❖ It supports decision-making, usually in solving semi-structured complex problems.
- ❖ It helps in refining managerial judgment applied to problem solving.
- ❖ It improves managerial decisions and thereby managerial effectiveness.
- ❖ The decision maker retains control over decisions throughout the decision process.

24.2.3 COMPONENTS OF DSS

Components of DSS include the following

1. DSS Database

DSS requires a database of its own. It can use data in organizational database. But this will slow down the application. There is also a risk of DSS applications modifying data in the organizational database. Hence, DSS generally uses data from its own database built up from transaction data drawn from organizational database and other relevant data collected from outside.

2. Model base

It contains a collection of mathematical and analytical models that the DSS

user may want to analyze the data. Each DSS is designed for a specific purpose such as firefighting, diagnostics, oil exploration etc. Hence, the models in the model base will vary from DSS to DSS. Generally, it contains statistical models, optimization models, forecasting models etc.

3. The Hardware

DSS requires hardware to provide the capability to the users to interact with the database and models using DSS applications.

4. The User interface

The user interface of DSS supports the interaction between the user and the data using the models.

5. Analysis tools

These include many tools which can be used at any level of management. The tools used at the three levels of management in an organization are as follows:

DSS Tools for operational Management

The operational management level requires assistance for day to day operations. The areas where DSS can support operational management include:

- Material requirement planning
- Linear programming
- Queuing theory
- Analysis of variance
- Correlation analysis
- Descriptive statistics like mean, median etc.

DSS Tools for Tactical Planning and Management Control:

- Dynamic programming
- Regression analysis
- Correlation analysis
- Factor analysis
- Multidimensional Scaling
- Game theory
- Discriminate analysis

- Non-linear programming
- Network analysis

DSS Tools for Strategic Planning

- Expert systems
- Natural language systems

24.2.4 DSS CAPABILITIES

DSS has acquired many capabilities over the years. Some of the major capabilities are as follows:

1. What if Analysis

This helps in analyzing the cause-effect relationship of variables. For example, if advertisement budget for a year is increased by 30% what will be its effect on total sales that year?

2. Model Building

Model building is a central task in most decision support systems. It involves mathematically specifying the relationship between variables. For example, a sales forecasting model based on advertisement expenditure will specify the relationship between sales and advertisement in terms of mathematical statement as:

Sales = 10.94 X Advertisement expenditure

It means sales turnover will be 10.94 times the advertisement expenditure for the period.

3. Sensitivity Analysis

This capability offers facility to analyze the effect of multiple variables. For example, what should be the cost of financing a project to get a return on investment of 20% after meeting costs of interest and other operations?

4. Risk Analysis

This facility provides a useful probability distribution to the decision maker to assess the risk involved. For example, a probability distribution of profit helps the decision maker to expect certain profit level with certain probability.

5. Goal Seeking Analysis

This facility is the reverse of 'what if' analysis. It answers questions like what should be the price per unit to generate a profit of $. 5, 000 from a project. This facility is normally available in spreadsheets.

6. Graphic Capability

This facility portrays data in the form of charts, graphs and diagrams to reveal underlying trends and patterns.

7. Exception Reporting Analysis

This facility tracks exceptions like overdue accounts; production runs that result in more power consumption than estimated, sales men who could not meet sales targets etc.

8. Hardware Capabilities

It can be implemented on a wide range of hardware configuration ranging from PC to mainframes.

9. Access to Database

DSS accesses data stored in databases also in external files. DSS tools have the capability to maintain internal files once data is retrieved from other sources.

24.3 GROUP DECISION SUPPORT SYSTEM (GDSS)

GDSS is designed to support joint decision making by two or more individuals. The decisions involved in GDSS are mostly unstructured. The group may make decisions in several settings like board rooms, conferences, videoconferences etc. The decision makers are in different places, yet the GDSS software brings them together in group decision making environment. GDSS provides support by facilitating electronic exchange of comments, views, suggestions and approval or disapproval. The system consists of advanced presentation devices, access to database and facilities for the decision makers to communicate electronically. All the participants in the group decision making are provided with computer-based support that includes data management, retrieval, graphical presentation tools, decision analysis capability, modeling etc.

24.3.1 TYPICAL GDSS CAPABILITIES INCLUDE:

1. **Display:** A work station screen or previously prepared presentation material.

2. **Electronic Brainstorming:** Participants communicate comments electronically.

3. **Topic Commenting:** Participants add comments to ideas suggested by others.

4. **Issue Analysis: Participants:** Identify and consolidate key items generated during electronic brainstorming.

5. **Voting:** Participants use the computer to vote on topics with a choice or prioritization methods.

6. **Alternative Evaluation:** The computer ranks alternative decisions based on preferences entered by participants.

DSS is a part of organizational MIS. MIS reports are still necessary for managers to monitor the ongoing operations. DSS complements the reports by enabling managers to make less structured decisions with greater confidence. DSS contains models, specialized database and user interface. It helps the decision maker to interact with the data using the models and generate information for solving semi-structured and unstructured problems. GDSS supports joint decision-making by two or more individuals involving mostly unstructured problems in an organizational setting.

24.4 CHAPTER SUMMATION

1. DSS is designed to support managerial decision-making, usually, at middle and top levels of management
2. DSS contains a database, models and data manipulation tools to help decision makers. It is useful where decisions are semi-structured or unstructured
3. There are two types of DSS. One is data-driven DSS and the other is model-driven DSS.

4. Components of DSS include the DSS Database, Model base, The Hardware, The User interface, Analysis tools.
5. DSS has many capabilities over the years. Some of them are: What if Analysis, Model Building, Sensitivity Analysis, Risk Analysis, and Graphic Capability.
6. GDSS is designed to support joint decision making by two or more individuals. GDSS capabilities include: Electronic Brainstorming, Topic Commenting, Voting etc.

24.5 DISCUSSION

1) Write short notes on DSS.
2) List out the characteristics of DSS.
3) Explain in detail the components of DSS.
4) Briefly explain the capabilities of DSS.
5) What is GDSS? Explain its capabilities.

24.6 CHAPTER PROGRESS

1.

i. It is designed and run by managers.
ii. It contains a database drawn from internal files and external environment. iii. It focuses on decision processes rather than on transaction processing. iv. It is concerned with a small area of managerial activity or a small part of a large problem.
v. It permits managers to test the probable results of alternative decisions.
vi. It supports decision-making, usually in solving semi-structured complex problems. vii. It helps in refining managerial judgment applied to problem solving.
viii. It improves managerial decisions and thereby managerial effectiveness.
ix. The decision maker retains control over decisions throughout the decision process.

CHAPTER TWENTY FIVE

EXPERT SYSTEMS

25.0 Aims and Objectives
25.1 Introduction
25.2 Expert Systems
25.2.1 Components of Expert System
25.2.2 Components of Expert System – An Alternative Approach
25.2.3 Characteristics of Expert System
25.2.4 When and Expert System Can Be Used?
25.2.5 Advantages of Expert System
25.2.6 Limitations of Expert Systems
25.2.7 Examples of Expert System
25.3 Chapter Summation
25.4 Discussions
25.5 Chapter Progress

25.0 AIMS AND OBJECTIVES

After reading this lesson, you will be able to understand:

1. Components of Expert System.
2. Characteristics of Expert System.
3. Limitations of Expert Systems and advantages of Expert System.

25.1 INTRODUCTION

Expert systems have evolved out of the work on artificial intelligence over the past few decades and are finding increasing applications in business. The system gathers together a database of knowledge or expertise to offer advice or solution for problems in a particular area by emulating the abilities and judgments of human experts. It accumulates all the expert knowledge in a given area so that the advice or solution offered is better than that of a single consultant or expert. It guides users through problems by asking them a set of questions about the problem. The answers given

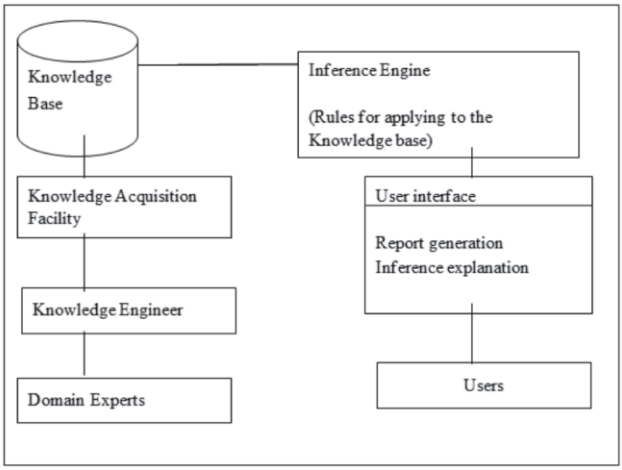
are checked against the rule base in the system to draw appropriate conclusions from the problem situation. Expert systems are particularly useful in dealing with unstructured problems.

25.2 EXPERT SYSTEMS

Expert system was originally developed to replicate abilities of human experts. The system captures and stores human knowledge in an area of expertise, called domain, it uses it to solve problems which otherwise requires the help of human experts. The solution suggested by the system is expected to be superior to that by any single expert.

Expert systems are designed to solve real problems in a particular domain that normally would require a human expert. It can solve many types of problems. It is designed to solve some problems very effectively. But it cannot solve every problem one might encounter in an area.

Developing an expert system involves extracting relevant knowledge from human experts in the area of problem, called domain experts. Such knowledge is often heuristic in nature. That is, it is some useful knowledge based on some "rules of thump" rather than absolute certainties. Acquisition of such rules of thumb and storing them in knowledge base are serious tasks in building a knowledge base. A knowledge engineer does this for knowledge acquisition and building a knowledge base.



The expert system consists of two major parts: the development environment and the consultation environment. The expert system builder uses the development environment to build the components and store expertise into the knowledge base. Non-expert user uses the consultant environment to get the expert opinion and advice from the expert system.

25.2.1 COMPONENTS OF EXPERT SYSTEM

The expert systems have the following components:

(1) Knowledge acquisition facility
(2) Knowledge base
(3) Knowledge-based management system
(4) Reasoning capability
(5) Work space
(6) Explanation facility
(7) Inference engine, and
(8) User interface

These components are briefly explained below:

1. Knowledge Acquisition Facility

Domain experts acquire expertise in their area of expertise over a long period. The expertise may be the result of their constant interaction with similar experts, observation and personal experience in the domain. Capturing expertise is one of the most difficult tasks of building knowledge base. This facility adds new knowledge and rules to the existing knowledge base and ensures its growth to meet emerging need. Usually a knowledge engineer takes care of this task. He identifies and interacts with the domain experts to gather expertise.

2. Knowledge Base

Knowledge base is just like the database of information system. It stores knowledge and rules and explanations associated with the knowledge. Knowledge representation is a major task in expert system building. The knowledge must be meaningfully represented in the system so that the system can relate to real world problems.

The knowledge base includes three knowledge such as:

a. Factual knowledge
b. Heuristic knowledge, and

c. Meta knowledge

The factual knowledge consists of facts about the domain, say, finance, medicine, design, etc., heuristic knowledge relates to the rules associated with a domain or problem area. Meta knowledge enables the expert system to use and analyses facts, extract those facts and specify the route to a solution. It refers to the ability of an expert system to learn from its own experience.

The knowledge base contains data and facts relevant to a problem area. The most common way to represent knowledge in expert systems is in the form of rules such as if ……then statements. Semantic networks and frames are other forms of knowledge representation in expert systems. The inference engine contains reasoning methods. It is a piece of software that probes the user and searches the knowledge base for the appropriate solution. The user interface links the user with the expert system. It sorts up screens for user-interaction with the system. Such interaction leads to identification and solution of problems.

3. Knowledge-based Management System

It is similar to a database management system in an information system. Its major task is to up data the knowledge base with knowledge and rules.

4. Work Space

The workspace or black board is a memory area used for describing the current problem, and storing intermediate results.

5. Explanation Facility

Most expert systems have explanation facilities. It explains how recommendations are derived. The user can know how the expert system arrived at the solution, why some alternatives were rejected, why some information was asked for etc. The explanation facility answers these questions by referring to the system goals, data input and the decision rules. For example, in case of loan proposal evaluation, the expert system's explanation facility will clarify on probing why one application was approved and why another was rejected. In case of a medical expert system such as Mycin, this facility builds confidence in the user about the

expert system and the solution it provides to problem.

6. Reasoning Capability or Knowledge Refinement

The expert system has the capability to analyze why its solution failed or succeeded and ways of improving its solution.

7. Inference Engine

The inference engine works like the model base in decision support system. It manipulates a series of rules using forward chinning and backward chaining techniques. In forward chaining the inference engine poses a series of if ….then condition checking. Based on the responses a particular solution is suggested. In backward chaining technique, the inference engine starts with the goal and checks whether the conditions leading to that goal are present.

8. User Interface

The system provides an interface for the users to interact with the system to generate solutions. It is similar to the dialogue facility in decision support system. The artificial intelligence technology tries to provide a natural language interface to users.

25.2.2 COMPONENTS OF EXPERT SYSTEM – AN ALTERNATE APPROACH

Another way to analyze expert system components is to look at the physical ingredients
Of the system as follows:

1. Hardware

Expert system shells operate on all types of hardware such as micro-computers, minicomputers and mainframe computers. Since microcomputers have become ubiquitous, it has become the standard hardware platform.

2. Software

Two types of software are needed for expert system: symbolic programs and expert system shells.

The expert systems were developed in symbolic programming languages. They have facility to process symbols rather than numbers. Expert system shells consist of a set of programs that provide an environment to declare rules and other knowledge. The shell also acts as an interface between the user and the expert system.

3. Knowledge

Expert system stores knowledge for decision-making. The knowledge may be represented in a meaningful way such as rule-based format or frame-based or a combination of both so that it can be retrieved to solve real-life problems.

4. People

Expert system requires some personnel with some expertise.

5. Knowledge Engineers

Knowledge engineers are responsible for creating an expert system. They interview domain experts and build knowledge base of the system. Their tasks are acquiring knowledge, modeling knowledge, and encoding knowledge.

6. Procedures

Both the users and expert system operators have to follow certain procedures for working with the expert system. The procedures for normal operations and recovery operations have to be developed and maintained.

25.2.3 CHARACTERISTICS OF EXPERT SYSTEM

The following are some of the characteristics of Expert system:

- Expert system is capable of handling challenging decision problems and delivering solutions. v Expert system uses knowledge rather than data for solution. Much of the knowledge is heuristic-based rather than algorithmic.
- The knowledge is encoded and maintained separately from the control program.
- Expert system has the capability to explain how the decision was made. It can also state why a particular piece of information was

needed for the solution.

25.2.4 WHEN AN EXPERT SYSTEM CAN BE USED

An Expert system can be used if the following conditions are met:

- The problem cannot be specified in terms of a well-defined algorithm. v The problem requires consistency and standardization. v The domain or problem area is narrow or limited. v When the task is hazardous. v There is scarcity of experts in the area. v The problem involves complex logic or a large number of rules.
- Human experts have successfully solved similar problems.

25.2.5 ADVANTAGES OF EXPERT SYSTEM

Expert System is an application area of artificial intelligence. Its purpose is to analyze how human experts make decisions and replicate this decision capability at affordable costs for organizations. It advantages are: v It enhances decision quality.

- It reduces the cost of consulting experts for problem solving.
- It provides quick and efficient solutions to problems in narrow area of specialization. v It offers high reliability of expert suggestions or decisions.
- It gathers scarce expertise and uses if efficiently.
- It can tackle very complex problems that are difficult for human experts to solve. v It can work on standard computer hardware.
- It can not only give solutions, but also the decision logic and how the solution was arrived at. Hence, the explanation facility permits a review of the decision and its logic.

25.2.6 LIMITATIONS OF EXPERT SYSTEMS

Expert System is not the result of a one-shot development. It is subjected to an iterative process of problem identification and refinement. Once the system is found to be working satisfactorily, it is implemented for consultation and decision-making. Some of the limitations of expert system are:

- It is difficult to extract expertise from human experts and hence the knowledge base may not be complete.

- Each problem situation is different from problem to problem. Hence, the solution suggested by a human expert is bound to be different from expert system solution.
- Expert system is effective in solving specific problems in narrow domains. It fails in properly analyzing problems in a larger area and in suggesting solutions.
- The cost and time required for developing expert system are very high. Hence, expert system is not affordable for most firms.
- Expert systems are expensive to build and maintain. In many cases the system has to be developed for the organization. If packages are installed they may have to be customized for the requirement of the organization.
- It is impossible to build any useful expert system as the expert system cannot capture all the assumptions on which real-life decisions are based.
- It takes long period of time to develop and fine tune an expert system. v Large expert systems are difficult to develop and maintain.

25.2.7 EXAMPLES OF EXPERT SYSTEM

- **Business Insight**

This expert system offers facility for strategic analysis. It is based on knowledge from over thirty business experts. It identifies strength, weaknesses, inconsistencies etc. And gives a through explanation. Business Resource Inc. developed this system.

- **Forecast Pro**

It is a business forecasting expert system. The expert system examines data and the program helps the users in forecasting using statistical tools like exponential smoothing, regression, Box-Jenkins etc. This software is from Business Forecast System.

- **Prospector**

It is designed for use in prospecting for minerals. It recommends probable sites for mineral deposits.

❖ **Mycin**

It is a famous expert system for medical diagnosis. It diagnoses blood infections and recommends treatment.

Expert system is an extension of the artificial intelligence. The system is designed for mimicking experts in there are of expertise. It collects and stores knowledge and rules in its knowledge base. A user interface is provided to the user to interact with the inference engine in generating solutions and getting explanations. Expert systems are useful in tackling complex problems without the help of experts. They are used in a wide variety of applications such as diagnosis, design, planning, forecasting and control. Even though it is extremely useful for decision-making, it has its own limitations.

25.3 CHAPTER SUMMATION

1. Expert systems are designed to solve real problems in a particular domain that normally would require a human expert.
2. The expert system consists of two major parts: the development environment and the consultation environment.
3. The expert system builder uses the development environment to build the components and store expertise into the knowledge base. Non-expert user uses the consultant environment to get the expert opinion and advice from the expert system.
4. The expert systems have the components such as knowledge acquisition facility, knowledge base, knowledge-based management system, reasoning capability, work space etc

25.4 DISCUSSIONS

1) What do you mean by expert system? Explain its components in detail.
2) List out the characteristics of expert system.
3) List out the advantages and limitations of expert system.

25.5 CHAPTER PROGRESS

1. Advantages of Expert system:

i). It enhances decision quality.

ii). It reduces the cost of consulting experts for problem solving.

iii). It provides quick and efficient solutions to problems in narrow area of specialization.
iv). It offers high reliability of expert suggestions or decisions.
v). It gathers scarce expertise and uses if efficiently.
vi). It can tackle very complex problems that are difficult for human experts to solve.
vii). It can work on standard computer hardware.
viii). It can not only give solutions, but also the decision logic and how the solution was arrived at. Hence, the explanation facility permits a review of the decision and its logic.

2. Knowledge base is just like the database of information system. It stores knowledge and rules and explanations associated with the knowledge. Knowledge representation is a major task in expert system building. The knowledge must be meaningfully represented in the system so that the system can relate to real world problems.

APPENDIX

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ABOUT THE BOOK

THIS book "Rudiments of Information Technology" is written with the sole purpose of improving individuals from different backgrounds on how they can become versatile with Information Technology in this age of the fourth industrial revolution.

The world today is witnessing another new dimension of revolution - the information Revolution - steered in with Technology. This Revolution is sweeping than any other revolution in history in its reach and influence, bringing about fundamental changes in all aspects of our life.

Just like many books are written strictly to address a particular course of study, this book is written to give you a background on becoming part of the Digital Age. Business executives, law enforcement agencies, academics, and ordinary citizens can comprehend the contents of this book.

Hence, this book is an extensive contribution to the realization and promotion of human rights to education and information considering IT areas. I will hope that the Rudiments given in this book will help you master basic computer knowledge and skills that will help you become a positive contributor to the world of IT, and with that hope, I wish you to learn as much as you can consequently becoming an active member of the Digital Community.

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